INFLUENCE OF ENVIRONMENTAL STRATEGY AND MANAGEMENT CONTROL ON ENVIRONMENTAL AND ECONOMIC PERFORMANCE

Miss Kanya Sannamwong

A Dissertation Submitted in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy in Accountancy
Department of Accountancy
FACULTY OF COMMERCE AND ACCOUNTANCY
Chulalongkorn University
Academic Year 2020

อิทธิพลของกลยุทธ์สิ่งแวดล้อมและการควบคุมทางการบริหาร ต่อผลการดำเนินงานด้านสิ่งแวดล้อมและด้านเศรษฐกิจ

น.ส.กัญญา แสนนามวงษ์

วิทยานิพนธ์นี้เป็นส่วนหนึ่งของการศึกษาตามหลักสูตรปริญญาศิลปศาสตรดุษฎีบัณฑิต
สาขาวิชาการบัญชี ภาควิชาการบัญชี
คณะพาณิชยศาสตร์และการบัญชี จุฬาลงกรณ์มหาวิทยาลัย
ปีการศึกษา 2563

Thesis Title	INFLUENCE OF ENVIRONMENTAL STRATEGY AND MANAGEMENT CONTROL ON ENVIRONMENTAL AND ECONOMIC PERFORMANCE
By	Miss Kanya Sannamwong
Field of Study	Accountancy
Thesis Advisor	Assistant Professor Wilasini Wongkaew, Ph.D.
Thesis Co Advisor	Assistant Professor DANUPOL HOONSOPON, DBA.

Accepted by the FACULTY OF COMMERCE AND ACCOUNTANCY, Chulalongkorn University in Partial Fulfillment of the Requirement for the Doctor of Philosophy

..... Dean of the FACULTY OF COMMERCE AND ACCOUNTANCY
(Associate Professor Wilert Puriwat, Ph.D.)

DISSERTATION COMMITTEE

..... Chairman
(Associate Professor PRAE KEERASUNTONPONG, Ph.D.)

..... Thesis Advisor
(Assistant Professor Wilasini Wongkaew, Ph.D.)

..... Thesis Co-Advisor
(Assistant Professor DANUPOL HOONSOPON, DBA.)

..... Examiner
(Associate Professor PRAPAPORN KIATTIKULWATTANA, Ph.D.)

..... Examiner
(Assistant Professor NAT KULVANICH, Ph.D.)

..... External Examiner
(Associate Professor Kanogporn Narktabtee, Ph.D.)

กัญญา แสนนามวงษ์ : อิทธิพลของกลยุทธ์สิ่งแวดล้อมและการควบคุมทางการบริหารต่อผลการดำเนินงานด้านสิ่งแวดล้อมและด้านเศรษฐกิจ. (INFLUENCE OF ENVIRONMENTAL STRATEGY AND MANAGEMENT CONTROL ON ENVIRONMENTAL AND ECONOMIC PERFORMANCE) อ.ที่ปรึกษาหลัก : ผศ. ดร.วิลาสินี วงศ์แก้วPh.D., อ.ที่ปรึกษาร่วม : ผศ. ดร.ดนุพล หุ่นโสภณDBA.

งานวิจัยนี้มีวัตถุประสงค์เพื่อศึกษาบทบาทของการควบคุมทางการบริหารสิ่งแวดล้อมในการถ่ายทอดกลยุทธ์สิ่งแวดล้อมเชิงแข่งขัน เพื่อนำไปสู่แนวปฏิบัติด้านสิ่งแวดล้อม รวมไปถึงศึกษาความสัมพันธ์ที่มีต่อผลการดำเนินงานด้านสิ่งแวดล้อมและด้านเศรษฐกิจ กลุ่มตัวอย่างคือบริษัทในอุตสาหกรรมการผลิตในประเทศไทยจำนวน 151 บริษัท เก็บข้อมูลจากการสำรวจระหว่างเดือนกันยายน ถึง พฤศจิกายน 2564 ผลการวิจัยพบว่าบริษัทส่วนใหญ่มีแนวโน้มใช้การควบคุมทางการบริหารสิ่งแวดล้อมแบบมีพิธีรีตรอง ซึ่งก่อให้เกิดความสอดคล้องระหว่างกลยุทธ์สิ่งแวดล้อมเชิงแข่งขันและแนวปฏิบัติด้านสิ่งแวดล้อม อันนำไปสู่ผลการดำเนินงานด้านสิ่งแวดล้อมและด้านเศรษฐกิจที่ดี ข้อเสนอแนะสำหรับผู้บริหารคือควรใช้การควบคุมทางการบริหารสิ่งแวดล้อมแบบมีพิธีรีตรอง เช่น การควบคุมทางการบริหารสิ่งแวดล้อมที่มุ่งเน้นกระบวนการมากกว่ามุ่งหวังเพียงผลลัพธ์ การควบคุมที่เป็นทางการ และการควบคุมอย่างละเอียด ซึ่งส่งผลให้แนวปฏิบัติด้านสิ่งแวดล้อมมีความสอดคล้องกับกลยุทธ์ขององค์กร นำมาซึ่งความได้เปรียบทางการแข่งขันอย่างยั่งยืน

สาขาวิชา การบัญชี ลายมือชื่อนิสิต .....

ปีการศึกษา 2563 ลายมือชื่อ อ.ที่ปรึกษาหลัก .....

ลายมือชื่อ อ.ที่ปรึกษาร่วม .....

5783201526 : MAJOR ACCOUNTANCY
KEYWORD: competitive environmental strategy, eco-control, strategic alignment, environmental performance, economic performance, competitive advantage

Kanya Sannamwong : INFLUENCE OF ENVIRONMENTAL STRATEGY AND MANAGEMENT CONTROL ON ENVIRONMENTAL AND ECONOMIC PERFORMANCE. Advisor: Asst. Prof. Wilasini Wongkaew, Ph.D. Co-advisor: Asst. Prof. DANUPOL HOONSOPON, DBA.

This study aims to explore the role of eco-controls in translating competitive environmental strategic intents into eco-practices, as well as the associations between eco-practices and environmental and economic performance. A web-based survey was used to collect data from 151 Thai manufacturing firms from September to November 2020. Structural Equation Modeling (SEM) was employed for data analysis. The findings from the study suggest that firms pursuing predominantly eco-efficiency intent, firms pursuing predominantly eco-branding intent, and firms pursuing both eco-efficiency intent and eco-branding intent at the same degree, tend to adopt more bureaucratic forms of eco-control regardless of their environmental strategic intents. In addition, the strategic alignment of eco-production practices fully mediates the relationship between eco-controls and eco-production practices, while the strategic alignment of eco-marketing practices fully mediates the relationship between eco-controls and eco-marketing practices. The study also revealed the direct effect of eco-marketing practices and the indirect effect of eco-production practices on environmental and economic performance. The implication for firms is that more bureaucratic forms of eco-control such as action control, formal control, and tight control are recommended to create a strategic alignment of eco-practices, which in turn, lead to sustainable competitive advantage.

Field of Study:	Accountancy	Student's Signature .....
Academic Year:	2020	Advisor's Signature .....
		Co-advisor's Signature .....

ACKNOWLEDGEMENTS

My dissertation would not have been accomplished without the support of many people. First of all, I would like to express my deepest gratitude to my advisor, Asst. Prof. Dr. Wila-sini Wongkaew, and my co-advisor, Asst. Prof. Dr. Danupol Hoonsopon for offering guidance and making valuable suggestions throughout the development of my research. I would like to express my sincere thanks to the dissertation committee: Assoc. Prof. Dr. Prae Keerasuntonpong (chairman), Assoc. Prof. Dr. Prapaporn Kiattikulwattana, Asst. Prof. Dr. Nat Kulvanich, and Assoc. Prof. Dr. Kanogporn Narktabtee, for their insightful comments that challenged me to look at different angles to improve my dissertation. I also would like to show my deeply gratitude to all my teachers at Chulalongkorn Business School for their support and encouragement, especially Asst. Prof. Dr. Pongprot Chatraphorn, Asst. Prof. Dr. Jirada Petaibanlue, and Dr. Jomsurang Ruangprapun.

I appreciate the support of my colleagues in the Ph.D. program: Dr. Varaporn Pothipala, Dr. Aranya Naklor, and Dr. Patcharee Treepornchaisak, who shared good times and bad times together. I also thank the Ph.D. alumni who always shared experiences, gave me heartfelt advice and made my Ph.D. life memorable. In addition, I owe thanks to the faculty officers, including Ms. Jaruwat Khocharoen for her care and assistance. I also indebted to colleagues at my workplace, Udon Thani Rajabhat University, for their assistance on any matters, not only about my studies, but also my life as well.

This Ph.D. study and dissertation would not have been possible if I have not been granted a scholarship and financial support from Udon Thani Rajabhat University, The 90th Anniversary of Chulalongkorn University Fund (Ratchadaphiseksomphot Endowment Fund), Prof. Dr. Uthai Tanlamai, and aunt Jitra P..

I am greatly thankful to my family and my husband for their love and support. Last but not least, I would dedicate the contribution of my work to my beloved nephew, who inspired me to support sustainability for future generations.

Kanya Sannamwong

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PART I

INTRODUCTION

INTRODUCTION

The two research articles in this dissertation are publications for the fulfilment of a Doctor of Philosophy (Accountancy) degree at Chulalongkorn Business School, Chulalongkorn University. The first article investigates the role of environmental management controls in translating environmental strategy into environmental practice. It also examines whether firms could achieve enhanced environmental and economic performance. The second article further explores whether environmental practices based on the circular economy concept are associated with economic performance. Both articles provide empirical evidence on the notion of a win-win situation in which firms could reduce environmental impacts while increasing economic benefits.

The dissertation is divided into three parts. Part I presents the motivation, objectives, scope, theoretical contributions, and practical implications of the research. Part II presents the first article "Strategic alignment of eco-practices: The mediator of eco-controls in translating environmental strategy" and the second article "The relationship between circular economy practices and economic performance: A study of manufacturing firms". Conclusion, implications, and limitations are presented in Part III.

RESEARCH MOTIVATION

Environmental issues, as a dimension of sustainability aside from the economic and social dimensions, have become increasingly of concern to businesses. It is argued that environmental issues have economic impacts; however, research examining the relationship between a firm's sustainability and financial performance has yielded inconsistent results (Grewatsch & Kleindienst, 2017). As a win-lose paradigm, it is argued that environmental-related activities lead to higher financial costs, therefore, lowering financial profit (Plaza-Úbeda et al., 2009). From this perspective, environmental-related activities require additional resources that increase costs and may reduce productivity. For example, firms might have to spend more on pollution-control technologies; environmental engineers may need to spend more time on environmental projects; and plant workers are likely to have additional workload in order to deal with recycled waste (Whitehead & Walley, 1994). Improving environmental performance is thus a process of transferring societal costs to firms. Hence, it might be seen as an unnecessary cost and effort by firms (Dixon-Fowler et al., 2013).

While a win-lose paradigm suggests a negative relationship between environmental and financial performance, a win-win paradigm, on the other hand, means that improving environmental performance could bring economic benefits (Burnett & Hansen, 2008; Chen et al., 2006; Dixon-Fowler et al., 2013; Hart, 1995; Henri & Journeault, 2010; Pérez-Calderón et al., 2011; Porter & Van der Linde, 1995; Russo & Fouts, 1997; Schaltegger, 2011). Pollution is a waste of resources; hence, improving efficiency via environmental performance could reduce costs and bring competitive advantage. Competitive advantage can be achieved from environmental activities, such as lower cost through efficient energy consumption, market share increases through environmentally-friendly products (Schaltegger, 2011), better negotiations with regulatory bodies and industry representatives (Plaza-Úbeda et al., 2009), a better environmental reputation, which may lead to social legitimacy, and potentially attract and retain qualified employees (Dixon-Fowler et al., 2013).

The relationship between environmental performance and economic performance may depend on a firm's contingent variables (Otley, 1980). Contingent variables could be moderators (Dixon-Fowler et al., 2013; Grewatsch & Kleindienst, 2017), as well as mediators (Grewatsch & Kleindienst, 2017). Moderators of the relationship between corporate sustainability and financial performance may come from the external environment, such as stakeholder relationships, industry characteristics, and the business environment. There can also be internal moderators, such as a firm's characteristics, differentiation between sustainability engagements, and managerial characteristics. An external mediator could be a stakeholder response while internal mediators can be intangible resources and capabilities (Grewatsch & Kleindienst, 2017; Hoonsopon & Puriwat, 2019). Previous environmental management accounting literature has provided some empirical evidence on this notion. For example, a firm's environmental and economic performance were found to be positively associated for large or public firms (Henri & Journeault, 2010). Firms that perceived high stakeholder concerns or high environmental concerns were found to gain more economic benefits from environmental initiatives (Henri & Journeault, 2010; Lisi, 2015). Environmental strategies (Henri & Journeault, 2018; Lisi, 2015; Stead & Stead, 1995; Wijethilake, 2017; Wijethilake et al., 2017), as well as top management environmental commitment (Lisi, 2015), influence the relationship between environmental and economic performance.

Environmental strategy, defined as the recognition of the importance of environmental issues and the integration of those into the strategic process (Banerjee et al., 2003; Dixon-Fowler et al., 2013; Perego & Hartmann, 2009; Pondeville et al., 2013), consists of a set of initiatives

that lower the natural environmental impact through products, processes, and corporate policies (Bansal & Roth, 2000). Environmental strategy can be measured by a classical continuum of environmental engagement from passive to proactive environmental strategy. A proactive environmental strategy means that a firm integrates environmental issues into the strategic planning process (Banerjee et al., 2003; Dixon-Fowler et al., 2013; Perego & Hartmann, 2009; Pondeville et al., 2013). A firm's environmental initiatives are voluntary and beyond regulatory requirements (Dixon-Fowler et al., 2013; Vishwakarma et al., 2018; Wijethilake, 2017). A proactive strategy focuses on preventing problems by dealing with the source of environmental problems. This approach may involve material substitution, process innovation, redesign, and the adoption of innovative technologies. In contrast, a reactive strategy does not explicitly involve the development or integration of environmental issues into business strategy but rather reacts to issues as they occur and can be driven by the need for legal compliance (Dixon-Fowler et al., 2013; Perego & Hartmann, 2009). This approach focuses on meeting legal requirements and usually requires the use of traditional end-of-pipe methods, such as trapping, storing, or treating emissions (Dixon-Fowler et al., 2013). Pondeville et al. (2013) considered environmental management and market orientation in their study and categorised firms into six groups: passive, reactive, median, active, market-oriented active, and proactive firms.

Apart from categorising environmental strategy by the level of engagement, a firm's environmental strategy can be classified in terms of the strategic orientation to be achieved. For example, firms that focus on improving the efficiency and productivity of the production process to lower the environmental impact and business costs can be defined as eco-efficiency intent firms (Henri & Journeault, 2018; Marchi et al., 2013; Orsato, 2009). On the other hand, firms that aim to promote environmentally-friendly products and environmental reputation to increase sales and market share can be defined as eco-branding intent firms (Journeault et al., 2016).

Extant literature suggests that environmental strategy influences the relationship between environmental performance and economic performance (Henri & Journeault, 2018; Lisi, 2015; Stead & Stead, 1995; Wijethilake, 2017; Wijethilake et al., 2017). However, the meta-analysis study of Dixon-Fowler et al. (2013) revealed that firms may gain economic benefits regardless of the level of environmental strategy engagement. These results may be explained by contingency theory, which posits that a firm's performance is likely to be high when the

firm's activities are consistent with the firm's strategy (Otley, 1980). Thus, it suggests that a firm's environmental practices should be consistent with the firm's environmental strategy.

Environmental practices (eco-practices) refer to an outcome of a deliberate stream of decisions, such as strategy implementation. However, environmental practices may not be consistent with the environmental strategy because of changes during strategy implementation (Langfield-Smith, 2006; Mintzberg, 1978). Contingency-based management accounting and control literature suggests that firms should adopt management control systems (MCSs) to maintain or alter the patterns of their activities to be consistent with their strategy (Merchant, 1982). It could be implied that environmental management controls (eco-controls) promote the congruence between environmental practices and environmental strategy (Arjaliès & Mundy, 2013).

Contingency-based management accounting and control literature suggests that a firm should adopt MCSs that suit its strategy (Chenhall, 2006; Christ & Burritt, 2013; Govindarajan & Shank, 1992; Otley, 2016; Otley, 1980). Since aspects of environmental strategy, such as eco-efficiency intent and eco-branding intent, are not mutually exclusive, multiple competitive environmental strategic intents are likely to be found (Journeault et al., 2016; Stead & Stead, 1995). Therefore, eco-controls adopted by firms must be able to balance the two competitive environmental strategic intents and translate both intents into practices. In sum, this dissertation aims to highlight the role of MCSs that encourage consistency between competitive environmental strategic intents and environmental practices. It also further investigates whether the fit between environmental practices and environmental strategy would bring environmental and economic benefits.

RESEARCH OBJECTIVES

This dissertation has three objectives. The first objective is to investigate whether contingent variables, such as firm characteristics and the firm's competitive environmental strategic intents, are associated with the form of eco-control adoption. The second objective is to investigate the role of eco-controls in translating competitive environmental strategic intents into eco-practices. The third objective is to investigate whether eco-practices affect environmental and economic performance.

RESEARCH SCOPE

Theoretical Framework and Key Definitions

This dissertation investigates the mediating role of MCSs in the relationship between competitive environmental strategy and environmental practices, which in turn, may affect environmental and economic performance. Figure 1. presents the theoretical framework of this dissertation, and Table 1. presents the key definitions.

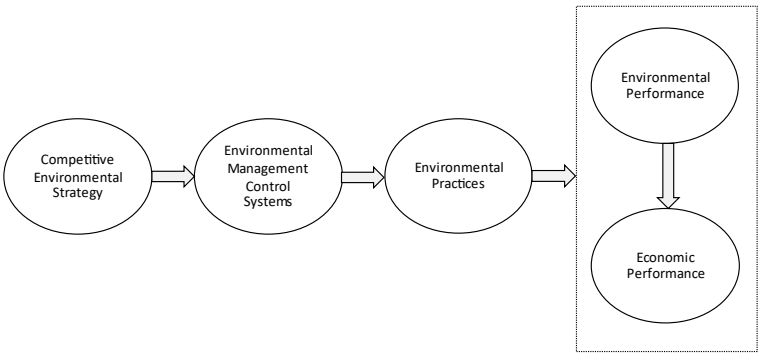

Figure 1. Theoretical framework

Table 1. Key definitions

	Definitions
Competitive environmental strategy	The integration of environmental determination into strategic intention in order to gain a competitive position (Journeault et al., 2016; Langfield-Smith, 2006)
Eco-efficiency intent	The strategic intention to improve the efficiency and productivity of the production process (Journeault et al., 2016)
Eco-branding intent	The strategic intention to promote environmentally-friendly products and environmental reputation (Journeault et al., 2016)
Environmental management control systems (Eco-controls)	The devices or systems that managers use to ensure consistency between employee behavior and a firm's environmental objectives and strategies (Henri & Journeault, 2010; Lopez-Valeiras et al., 2015; Merchant, 1982)
Environmental practices (Eco-practices)	Environmental activities that enhance environmental performance (González-Benito & González-Benito, 2005)
Environmental performance	Waste management, Water management, Air emission control, Noise management, Smell management, Energy management (Henri & Journeault, 2018; Suansawat, 2013)
Economic performance	Market share, Total revenue, Cash flow from operations, Operating profits, Return on investment (ROI) (Henri & Journeault, 2010)

Samples

The samples of the study are manufacturing firms operating in industrial estates under the responsibility of the Industrial Estate Authority of Thailand (IEAT) (Industrial Estate Authority of Thailand, 2020). A total of 1,323 manufacturing firms located in Ayutthaya, Prachin Buri, Chachoengsao, Chonburi, and Rayong provinces were selected because of the density of IEs in these areas. In addition, they consist of a wide range of major industries which are significant in the Thai economy (Lunkam, 2020). A web-based survey was used to collect data from September to November 2020.

Firms operating in high-pollution industries tend to embed environmental concerns into their activities more than firms in low-polluting industries (Henri & Journeault, 2018). Hence, sample firms in ten high-polluting industries were selected. High-polluting industries are (1) wood and wood products, (2) paper and pulp, (3) petroleum and coal products, (4) chemical products, (5) metal products, (6) machinery, (7) electronics, (8) automotive and compartments, (9) textiles, and (10) recycling (Christ & Burritt, 2013; Henri & Journeault, 2018; Mokhtar et al., 2016; Setthasakko, 2010; Suansawat, 2013; Ussahawanitchakit, 2017).

RESEARCH CONTRIBUTIONS

This dissertation adds to contingent-based management accounting and control literature by providing empirical evidence on the association between a firm's contingent variables and the adoption of environmental-related MCSs. In particular, this dissertation enriches environmental management control literature by providing empirical evidence on how eco-controls translate environmental strategic intents into eco-practices, or in other words, how it translates intended strategy into realized strategy. Thus, it responds to the call for literature that explicitly distinguishes between intended strategy and realised strategy (Langfield-Smith, 2006). Lastly, it provides empirical evidence that supports a win-win paradigm in which firms could gain environmental and economic benefits by adopting eco-practices that are consistent with environmental strategy. A managerial implication of this dissertation is that management should adopt environmental-related MCSs to achieve a sustainable competitive advantage.

The remainder of this dissertation is organised as follows: the next section includes two research articles. The first article is a manuscript prepared for submission to the Asian Academy of Management Journal (AAMJ), while the second article was accepted and published in the Journal of Management Science, Udon Thani Rajabhat University on

Volume 3 Issue 3 (May – June 2021) Page 11-24. The last section presents the conclusions, implications, and limitations of the study.

PART II

RESEARCH ARTICLES

STRATEGIC ALIGNMENT OF ECO-PRACITCES: THE MEDIATOR OF ECO-CONTROLS IN TRANSLATING ENVIRONMENTAL STRATEGY

Kanya Sannamwong[1], Wila-sini Wongkaew[1]*, and Danupol Hoonsopon[1]

[1]Chulalongkorn Business School, Chulalongkorn University,
254 Phyathai Road, Pathumwan District, Bangkok 10330

*Corresponding author: wilasini@cbs.chula.ac.th

This article is a manuscript prepared for submission to the Asian Academy of Management Journal (AAMJ).

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Kanya Sannamwong[1], Wila-sini Wongkaew[1]*, and Danupol Hoonsopon[1]

[1]Chulalongkorn Business School, Chulalongkorn University,
254 Phyathai Road, Pathumwan District, Bangkok 10330, Thailand.

*Corresponding author: wilasini@cbs.chula.ac.th

ABSTRACT

This study aims to explore the role of eco-controls in translating competitive environmental strategic intents into eco-practices, as well as the associations between eco-practices and environmental and economic performance. A web-based survey was used to collect data from 151 Thai manufacturing firms from September to November 2020. Structural Equation Modeling (SEM) was employed for data analysis. The findings from the study suggest that firms pursuing predominantly eco-efficiency intent, firms pursuing predominantly eco-branding intent, and firms pursuing both eco-efficiency intent and eco-branding intent at the same degree, tend to adopt more bureaucratic forms of eco-control regardless of their environmental strategic intents. In addition, the strategic alignment of eco-production practices fully mediates the relationship between eco-controls and eco-production practices, while the strategic alignment of eco-marketing practices fully mediates the relationship between eco-controls and eco-marketing practices. The study also revealed the direct effect of eco-marketing practices and the indirect effect of eco-production practices on environmental and economic performance. The implication for firms is that more bureaucratic forms of eco-control such as action control, formal control, and tight control are recommended to create a strategic alignment of eco-practices, which in turn, lead to sustainable competitive advantage.

Keywords: competitive environmental strategy, eco-control, strategic alignment, environmental performance, economic performance, competitive advantage

INTRODUCTION

Environmental issues have become an increasing matter of concern for business organisations. Many firms have developed competitive environmental strategies by integrating environmental determination into their strategic intention in determining their competitive position (Journeault et al., 2016; Langfield-Smith, 2006). Environmental strategic intention can be broadly classified into two dimensions – eco-efficiency and eco-branding (Journeault et al., 2016; Marchi et al., 2013; Orsato, 2009). On the one hand, eco-efficiency strategic intent refers to the focus on improving the efficiency and productivity of the production process. On the other hand, eco-branding strategic intent refers to offering and promoting environmentally-friendly products that are different from those of competitors (Journeault et al., 2016).

The proponents of eco-efficiency strategic intent argue that inefficient production processes create pollution and increase business costs. By improving the efficiency of production processes, firms can benefit from material and energy savings, and can therefore improve their economic performance (Burnett & Hansen, 2008; Chen et al., 2006; Dixon-Fowler et al., 2013; Henri & Journeault, 2010; Journeault et al., 2016; Pérez-Calderón et al., 2011; Plaza-Úbeda et al., 2009; Porter & Van der Linde, 1995; Schaltegger, 2011). Firms that pursue eco-branding strategic intent can enhance economic performance by accessing new markets and by responding quickly to green consumers' expectations (Ginsberg & Bloom, 2004; Jeeravorawong & Hoonsopon, 2015; Journeault et al., 2016; Moravcikova et al., 2017; Schaltegger, 2011).

Despite the claims and some empirical evidence that shows that having an explicit strategic environmental intent can enhance a firm's economic performance, it is possible that firms may fail to translate their intended strategy into realized strategy. Such a failure is possibly due to unrealistic expectations, misinterpretation of the environment, or changes of plan during implementation (Langfield-Smith, 2006; Mintzberg, 1978). In order to ensure that environmental strategic intent is translated into practice, management control systems (MCSs), particularly eco-controls, can play an important role.

Eco-controls are a part of management control systems. They are implemented by management to ensure that the behaviour of their subordinates is consistent with the environmental objectives and strategies of the firm (Henri & Journeault, 2010; Hoonsopon & Puriwat, 2021; Merchant, 1982; Slagmulder, 1997). Prior literature has provided some evidence of the association between eco-controls and a firm's environmental and economic

performance. For example, Henri and Journeault (2010) and Journeault (2016) found that eco-controls, based on a management control package (Malmi & Brown, 2008), were associated with a firm's environmental and economic performance. Journeault (2016) also proposed that an eco-control package fosters a firm's environmental capabilities, which contribute to their performance. In a similar vein, Henri and Journeault (2018) and Lisi (2015) examined the antecedents and consequences of eco-control adoption and found that eco-control adoption positively affects environmental and economic performance.

While empirical studies have revealed relationships between environmental strategy, eco-control adoption and firms' environmental and economic performance, Journeault et al. (2016) argued that existing literature has not yet distinguished between intended and realised environmental strategy. When investigating environmental strategy, extant literature has tended to focus on the implementation of various eco-practices (i.e., realised strategy), rather than intended strategy. The links between intended and realised strategy and the role of eco-control in translating intended strategy into realised strategy have received little academic attention. Journeault et al. (2016) conducted a survey among Canadian manufacturing firms. The findings from the study suggest that the levers of eco-control were implemented differently for firms displaying predominantly eco-efficiency intent and firms displaying predominantly eco-branding intent.

Journeault et al. (2016) shed some light on the role of eco-controls in translating competitive environmental strategic intent into eco-practices. However, they did not examine whether the alignment between competitive environmental strategic intent, eco-controls and eco-practices is associated with superior environmental and economic performance. In addition, although Journeault et al. (2016) recognized that eco-efficiency and eco-branding intents are not mutually exclusive and firms may display both eco-efficiency and eco-branding strategic intents, they classified firms into those exhibiting predominantly eco-efficiency intent and those exhibiting predominantly eco-branding intent. The eco-controls of firms, which focus on both types of intent, are unexplored. Therefore, in this study, the eco-controls of firms which focus on both eco-efficiency and eco-branding intents equally are explored. Linkages to environmental and economic performance will also be examined.

To examine the issues, managers in manufacturing firms were contacted to participate in a web-based survey. Manufacturing firms in high-polluting industries were chosen as samples as they tend to embed environmental aspects into their activities more than low-polluting firms (Henri & Journeault, 2018). This study was conducted in Thailand where high power

distance and high uncertainty avoidance are exhibited (Hoonsopon & Ruenrom, 2012; Shutibhinyo & Wongkaew, 2017). In this cultural context, formal rules and the acceptance of a hierarchical order are commonly found (Chenhall, 2006; Hofstede, 1984; Vance et al., 1992). The findings from the study are complementary to the existing literature which has tended to focus on firms in western contexts.

The remainder of the article is organised as follows. The next section provides a review of the existing literature and the development of hypotheses. Then, research design is presented, followed by the results, discussion, and conclusion of the study.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Environmental Strategy – Environmental Strategic Intents and Eco-practices

A competitive environmental strategy refers to the integration of environmental issues into a firm's strategic process to create a competitive advantage (Banerjee et al., 2003; Dixon-Fowler et al., 2013; Perego & Hartmann, 2009). In the existing literature, two main environmental strategic intentions have been identified, namely eco-efficiency and eco-branding (Journeault et al., 2016). Eco-efficiency intent relies on production and engineering functions by adopting technological processes to reduce cost and improve efficiency. For firms pursuing eco-efficiency intent, environmental competitiveness could be achieved from higher production efficiency when compared to competitors. Eco-efficiency strategic intent shares similar aspects with a cost leadership strategy, as addressed in management literature (Langfield-Smith, 2006; Shrivastava, 1995). While eco-efficiency strategic intent is similar to cost leadership strategy, firms pursuing eco-branding intent are similar to those pursuing differentiation strategy. These firms tend to focus on seeking market opportunities and attempt to be the first to respond to change and uncertainty (Aragón-Correa, 1998). This strategy aims to provide customers with high quality and dependable products. By focussing on marketing and research and development functions, eco-branding intent firms can increase their revenue by accessing new markets and by responding quickly to green customers' expectations (Journeault et al., 2016). Although environmental strategic intentions can be broadly classified into two dimensions, it is important to note that these dimensions are not mutually exclusive. Firms may adopt multiple competitive environmental strategic intents at the same time with varying degrees of intensity (Journeault et al., 2016; Stead & Stead, 1995).

While having environmental strategic intentions may be important, it may be insufficient to enhance firms' environmental and economic performance. As Journeault et al. (2016), argued,

existing literature that has examined and found positive relationships between environmental strategy and performance has tended to focus on the implementation of eco-practices although the phrase 'environmental strategies' is employed. However, environmental strategies and eco-practices are different. While environmental strategies or strategic intentions refer to intended strategies related to the environmental issues of the firm, eco-practices refer to actual environmental activities, which represent realised strategies.

Drawing on existing literature, eco-practices can be classified into two different sets, namely eco-production practices and eco-marketing practices. On the one hand, eco-production practices refer to actions related to the environmental redesign of products and processes, material substitution, reduction of energy consumption, waste disposal, and recycling (González-Benito & González-Benito, 2005; Henri & Journeault, 2018; Journeault et al., 2016; Melnyk et al., 2003; Orsato, 2009; Shrivastava, 1995). On the other hand, eco-marketing practices refer to the integration of environmental activities into marketing processes. This could involve surveillance of the market for environmental opportunities, the use of environmental arguments in marketing activities, and communications about the firm's environmental awareness and commitment to stakeholders (Aragón-Correa, 1998; Ginsberg & Bloom, 2004; González-Benito & González-Benito, 2005; Journeault et al., 2016; Marchi et al., 2013; Melnyk et al., 2003; Orsato, 2009).

In order to support the translation of environmental strategic intents into eco-practices, eco-controls can play important roles. As depicted in contingency-based management control literature, having a fit between strategy and management control systems can help firms to achieve superior performance (Chenhall, 2006; Christ & Burritt, 2013; Otley, 2016; Otley, 1980). In the context of environmental management, having eco-controls which suit the environmental strategy may also help firms to realise its environmental strategies.

Eco-controls

When applying the management control definition in an environmental context, eco-controls refer to devices or systems that managers use to ensure consistency between employees' behaviour and the firm's environmental objectives and strategies (Henri & Journeault, 2010; Lopez-Valeiras et al., 2015; Merchant, 1982). Well-designed eco-controls can maintain and alter patterns of employees' behaviour towards environmental goals (Arjaliès & Mundy, 2013; Heggen & Sridharan, 2020; Henri & Journeault, 2010; Henri & Journeault, 2018; Journeault, 2016; Journeault et al., 2016; Lopez-Valeiras et al., 2015; Pondeville et al., 2013). To be more specific, eco-controls can mitigate some problems, such as employees' lack of

direction, personal limitations, and lack of motivation. Directions for achieving environmental objectives are provided by specific detailed instructions on how environmental-related tasks are to be performed. The availability of ecological information for decision-making will enhance the personal ability to process new information, and performance measurement and reward systems which are linked to the firm's environmental objectives will stimulate goal congruence between employees and the firm (Lueg & Radlach, 2016; Merchant, 1982; Strauß & Zecher, 2013).

As suggested by Merchant (1982), good control is multi-dimensional. Therefore, in this study, eco-controls are measured in three dimensions. The first dimension is related to environmental performance measures (action control versus result control). The second dimension is the degree of formality in communicating environmental policies and procedures to organisational members (formal control versus informal control), and the third dimension is the degree of tightness in environmental expenses and investment controls (tight control versus loose control) (Auzair & Langfield-Smith, 2005). These three dimensions of eco-controls can be placed along the continuum of bureaucratic form of eco-controls. Specifically, action control, formal control, and tight control are at one end of a more bureaucratic form of eco-controls. The other end of the continuum consists of result control, informal control, and loose control, which is a less bureaucratic form of eco-control. Practically, firms may adopt eco-controls along this bureaucratic continuum (Auzair & Langfield-Smith, 2005).

Contingency-based management literature has posited that the performance of a firm is likely to be high when controls and strategies are compatible (Chenhall, 2006; Christ & Burritt, 2013; Govindarajan & Shank, 1992; Otley, 2016; Otley, 1980). An appropriate form of eco-control may help support the alignment between competitive environmental strategic intents and eco-practices. The strategic alignment of eco-practices ensures that strategic intent is communicated and implemented at the functional level, which may lead to a better use of resources (Slagmulder, 1997) and a competitive advantage (Chenhall, 2005).

Conceptual Model

The conceptual model of this study is presented in Figure 2. Extant literature has suggested that there are connections between competitive environmental strategic intents, eco-controls, eco-practices, and firm performance. Journeault et al. (2016) found that competitive environmental strategic intents affect eco-controls. They also find linkages between eco-controls and eco-practices. Eco-control literature suggests relationships between eco-controls, eco-practices, and firm performance (Henri & Journeault, 2010; Henri & Journeault,

2018). Therefore, this study proposes the strategic alignment of eco-practices as a mediator on the relationship between eco-controls and eco-practices.

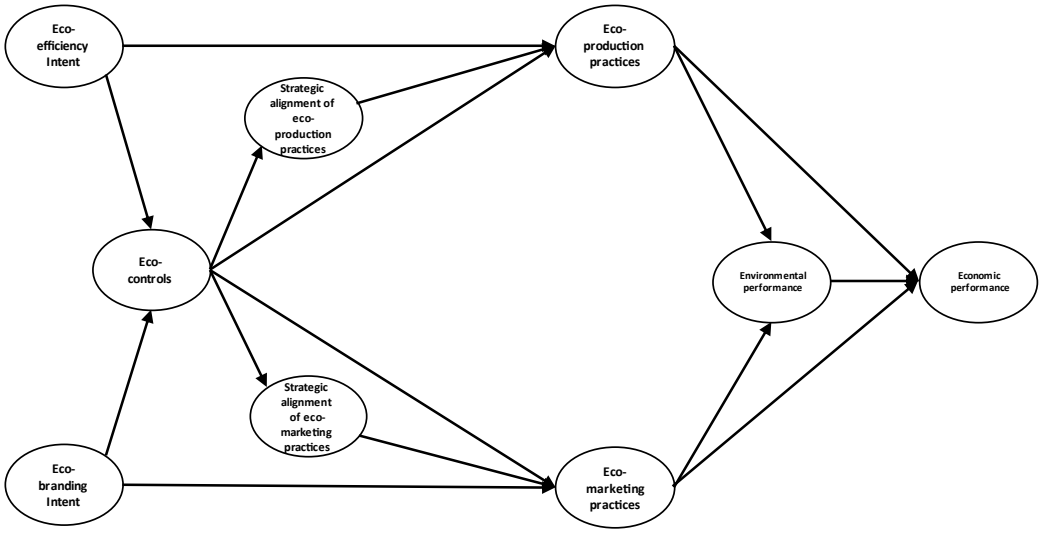

Figure 2. The conceptual model

Firm Characteristics and the Degree of Bureaucratic Forms of Eco-control

Firm characteristics, such as firm size, public visibility, having an environmental certificate (ISO14001), an own brand, and international ownership, can be contingent variables that influence the form of eco-control adoption. First, large firms tend to receive greater benefits from environmental activities than small firms due to the potential for greater cost savings or revenue (Henri & Journeault, 2010). In addition, large firms tend to have more diversified operations and many layers of management; hence, more formal procedures and greater bureaucracy are needed (Chenhall, 2006; Hendricks & Singhal, 2001). Therefore, it can be reasonably assumed that there is a positive association between firm size and the degree of bureaucratic forms of eco-control.

Second, firms that are exposed to public scrutiny tend to voluntarily adopt eco-practices to show their commitment to environmental protection. Listed firms have more public visibility than non-listed firms; hence, they tend to adopt more bureaucratic forms of eco-control (Henri & Journeault, 2010). This study expects that there is a positive relationship between public visibility and the degree of bureaucratic forms of eco-control.

Third, firms that are ISO14001 certified tend to establish clear environmental policies, objectives, procedures, and measurements to promote continuous improvement. ISO14001 is viewed as an indicator of competitive advantage because it is an extension of Total Quality Management (Morrow & Rondinelli, 2002; Virtanen et al., 2013). In addition, having an environmental certificate was found to be associated with environmental management (Windolph et al., 2014). This study expects that there is a positive relationship between ISO14001 certification and the degree of bureaucratic forms of eco-control.

Fourth, unlike original equipment manufacturers (OEMs) or original design manufacturers (ODMs), firms whose major activities are in producing components for other companies, original brand manufacturers (OBMs) offer customers their own brand products. OBMs were found to be more likely to adopt informal management and employee empowerment (Henkel et al., 2007). Thus, OBMs are expected to have a negative association with the degree of bureaucratic forms of eco-control.

Lastly, international firms need to optimize their global research, production, and marketing capabilities to achieve a global competitive advantage. Although both bureaucratic control and cultural control can be important, cultural control may struggle as a result of home country bias. Therefore, strict and explicit rules and procedures are more appropriate, especially in regard to technical issues (Pucik & Katz, 1986). Subsidiaries of international firms may have more bureaucratic forms of eco-control. Thus, international ownership is expected to have a positive relationship with the degree of bureaucratic forms of eco-control.

To conclude, it is likely that firm size, public visibility, environmental certification, major activity, and international ownership may have an association with the degree of bureaucratic forms of eco-control. This leads to the following hypothesis:

H1: Firm characteristics have an association with the degree of bureaucratic forms of eco-control.

The Fit Between Competitive Environmental Strategic Intent and Bureaucratic Forms of Eco-control.

Environmental strategic intents are classified into eco-efficiency and eco-branding. However, as previously argued, firms may adopt multiple competitive environmental strategic intents (Journeault et al., 2016; Stead & Stead, 1995). Therefore, three groups of firms are likely to be found, based on their predominant environmental strategic intents. The first group consists

of firms that exhibit a higher degree of eco-efficiency intent than eco-branding intent. Firms in this group are called predominant eco-efficiency strategic intent firms. The second group consists of firms that display a higher degree of eco-branding intent than eco-efficiency intent, therefore, referred to as predominant eco-branding strategic intent firms (Journeault et al., 2016). In the third group, firms exhibit the same degree of focus for eco-efficiency and eco-branding intents. These firms are referred to as multiple competitive environmental strategic intent firms.

As previously argued, firms that predominantly pursue eco-efficiency strategic intent share similar characteristics with firms pursuing cost leadership strategy. In contrast, predominantly eco-branding strategic intent firms are more like differentiators. Therefore, it is reasonable to argue that MCSs, which are appropriate for cost leadership firms, are also appropriate for predominantly eco-efficiency strategic intent firms. In a similar vein, MCSs, which are appropriate for firms pursing differentiation strategy, are appropriate for firms predominantly displaying eco-branding intent. Drawing on this argument, it can be suggested that predominant eco-efficiency strategic intent firms rely more on action control, which placing an emphasis on staff decisions and actions on an ongoing basis, while predominant eco-branding strategic intent firms will place a greater focus on result control, such as the attainment of environmentally-desired targets. Furthermore, it is likely that predominant eco-efficiency strategic intent firms will adopt more formal and tight controls to force subordinates to focus on tasks and to prevent them from working outside strict boundaries. In contrast, firms that predominantly exhibit eco-branding intent are more likely to employ informal and loose controls to allow employees to be innovative in creating unique products (Auzair & Langfield-Smith, 2005). In sum, eco-efficiency intent is expected to be associated with more bureaucratic forms of eco-control, while eco-branding intent is expected to be associated with less bureaucratic forms of eco-control. It can be assumed that multiple competitive environmental strategic intents that pursue both types of intent equally are associated with neutral bureaucratic forms of eco-control.

Contingency-based management literature reveals that the performance of a firm is likely to be high when controls and strategies are compatible (Chenhall, 2006; Christ & Burritt, 2013; Govindarajan & Shank, 1992; Otley, 2016; Otley, 1980). It can be inferred that the fit between competitive environmental strategic intent and the form of eco-control can be associated with firm performance. Specifically, the fit between competitive environmental strategic intents and the form of eco-control is achieved when predominant eco-efficiency

strategic intent firms adopt more bureaucratic forms of eco-control, and predominant eco-branding strategic intent firms adopt less bureaucratic forms of eco-control. Multiple competitive environmental strategic intent firms are more likely to adopt moderate bureaucratic forms of eco-control.

Strategic Alignment of Eco-practices

Firms are considered successful in translating their competitive environmental strategic intents into realised strategy when they have successfully implemented eco-practices. Eco-practices refer to the environmental approaches that increase environmental performance (González-Benito & González-Benito, 2005). Extant literature indicates that environmental activities in production functions may lead to cost savings from more efficient use of resources. For example, redesigning products and processes by using material substitution can reduce the use of energy and materials. In addition, implementing cleaner production may reduce emissions and potential environmental problems. Moreover, redesigning products or processes for ease of disassembly and reassembly, recycling, and using waste output from one process as a material for another process would reduce resource consumption (González-Benito & González-Benito, 2005; Henri & Journeault, 2018; Journeault et al., 2016; Melnyk et al., 2003; Orsato, 2009; Porter & Van der Linde, 1995; Shrivastava, 1995). Therefore, firms that aim to use resources efficiently may adopt these eco-production practices in order to gain benefits from cost reduction.

While activities related to the production function are associated with the efficient use of resources, activities that involve marketing functions aim to increase revenue by responding to environmentally-concerned consumers. For example, firms may integrate environmental activities into marketing processes by looking for environmental opportunities. Environmental arguments can also be used in marketing to increase sales. Furthermore, communications about a firm's environmental awareness and commitment to stakeholders may lead to an enhanced environmental image and reputation (Aragón-Correa, 1998; Ginsberg & Bloom, 2004; González-Benito & González-Benito, 2005; Journeault et al., 2016; Marchi et al., 2013; Melnyk et al., 2003; Orsato, 2009). These practices, which intend to attract green consumers, are referred to as eco-marketing practices. Firms implement such eco-marketing practices in order to boost revenue and market share.

Although eco-production practices tend to support eco-efficiency intent and eco-marketing practices tend to support eco-branding intent, in practice, eco-practices at a firm may not support its competitive environmental strategic intents. Slagmulder (1997) argued strategic

misalignment may result from information asymmetry, uncertainty, or goal incongruence. Information asymmetry occurs when the intent is not completely communicated within the firm. Strategic misalignment may lead to inappropriate investment, delayed decision-making, or the inefficient use of resources. Slagmulder suggested that the implementation of appropriate MCSs would support strategic alignment. For example, firms may tighten control when a strong information flow is needed. Alternatively, firms may relax control if creativity is desired.

While Slagmulder (1997) explained how firms achieve strategic alignment by adopting MCSs, Chenhall (2005) provided evidence that strategic performance measurement systems have an indirect effect on competitive advantages through the mediating role of the strategic alignment of manufacturing. Such competitive advantages include low production costs, high quality and unique products, and dependable deliveries. When applying Chenhall's (2005) argument in an environmental context, the strategic alignment of eco-practices refers to coherence between eco-practices and competitive environmental strategic intents. This suggests that a firm's policies, investments and activities should be consistent with its environmental strategic intent. Henri and Journeault (2018) argued that eco-controls promote environmental goal congruence, provide relevant information for environmental decision making, and support better resource allocation. Thus, adopting eco-controls can reduce or even eliminate strategic misalignment. The strategic alignment of eco-practices is expected to support the deployment of competitive environmental strategic intent at the operational level, such as production and marketing functions. Therefore, eco-controls are likely to affect eco-production practices through the strategic alignment of eco-production practices and eco-marketing practices through the strategic alignment of eco-marketing practices.

The strategic alignment of eco-practices means that firms focus on eco-practices that are consistent with their competitive environmental strategies. Three groups of eco-practices are identified in this study. The first group consists of firms which focus predominantly on eco-production practices. The second group consists of firms which focus on predominantly eco-marketing practices, and the last group is a neutral eco-practices group, where eco-production practices and eco-marketing practices are both implemented.

In sum, a predominantly eco-efficiency strategic intent firm has strategic alignment of eco-practices when it focuses predominantly on eco-production practices. A predominantly eco-branding strategic intent firm has strategic alignment of eco-practices when it predominantly adopts eco-marketing practices. A multiple competitive environmental strategic intent firm

has strategic alignment of eco-practices when it adopts neutral eco-practices. These lead to the following hypothesis:

H2: Firms adopting the bureaucratic forms of eco-control that match their competitive environmental strategic intents have higher level of strategic alignment of eco-practices than firms adopting the bureaucratic forms of eco-control that do not match their competitive environmental strategic intents.

Since literature has suggested that firms rely on eco-controls in translating competitive environmental strategic intents into eco-practices (Arjaliès & Mundy, 2013; Heggen & Sridharan, 2020; Henri & Journeault, 2018; Journeault, 2016; Journeault et al., 2016; Lopez-Valeiras et al., 2015; Pondeville et al., 2013), the following hypotheses are proposed:

H3a: Eco-efficiency intent has a positive direct effect on eco-production practices.

H3b: Eco-branding intent has a positive direct effect on eco-marketing practices.

H4a: Eco-efficiency intent has a positive direct effect on eco-controls.

H4b: Eco-branding intent has a positive direct effect on eco-controls.

H5a: Eco-controls have a positive direct effect on eco-production practices.

H5b: Eco-controls have a positive direct effect on eco-marketing practices.

H6a: Eco-controls have a positive direct effect on the strategic alignment of eco-production practices.

H6b: Eco-controls have a positive direct effect on the strategic alignment of eco-marketing practices.

H7a: The strategic alignment of eco-production practices has a positive direct effect on eco-production practices.

H7b: The strategic alignment of eco-marketing practices has a positive direct effect on eco-marketing practices.

Eco-practices and Firm Performance

Existing studies noted an association between eco-practices and a firm's environmental performance (Aragón-Correa, 1998; Chen et al., 2006; Henri & Journeault, 2010; Henri & Journeault, 2018; Suansawat, 2013). It is argued that superior environmental performance may come from improving internal processes to reduce environmental impacts. Eco-

production practices, such as redesigning the production process, may reduce emissions, water waste, solid waste, and hazardous waste (Henri & Journeault, 2018). They could also prevent unexpected incidents that potentially harm the ecosystem (Suansawat, 2013). The redesign of the product for ease of disassembly and reassembly may prolong product life (Bocken et al., 2016). These eco-production practices not only bring better environmental performance, but also yield economic performance. For instance, increasing process efficiency can reduce manufacturing and waste disposal cost (Burnett & Hansen, 2008; Dixon-Fowler et al., 2013; Hart, 1995; Henri & Journeault, 2010; Henri & Journeault, 2018; Pérez-Calderón et al., 2011; Porter & Van der Linde, 1995; Schaltegger, 2011; Shrivastava, 1995). Reducing emissions below the requirement and avoiding toxic materials can lower environmental discharges and liability (Henri & Journeault, 2010; Henri & Journeault, 2018; Pérez-Calderón et al., 2011). Using recycled materials may reduce organisational risk such as resource scarcity in the future (Henri & Journeault, 2010; Shrivastava, 1995).

While eco-production practices try to reduce impacts on natural resources, eco-marketing practices influence the behaviour of stakeholders. For instance, promoting products made from recycled or recyclable raw materials lessens natural resource consumption and the demand for primary products (Zink & Geyer, 2017). The use of environmental arguments, or applying a non-consumerist approach in marketing, may encourage responsible consumption (Bocken et al., 2016; Shrivastava, 1995). Collaboration with stakeholders may help firms to identify environmental opportunities to reduce its environmental impact on communities (Henri & Journeault, 2018). Voluntary disclosure of a firm's environmental management may encourage firms to be more responsible for their environmental performance (Henri & Journeault, 2018). These eco-marketing practices not only benefit the environment, but also benefit the firm's economic performance. Firms may increase revenue by being the first to respond to the demand for green products (Ginsberg & Bloom, 2004; Henri & Journeault, 2018; Schaltegger, 2011; Shrivastava, 1995). Sponsorship of environmental events may improve public relations. Environmental reputation may bring social legitimacy (Ginsberg & Bloom, 2004; Hart, 1995; Henri & Journeault, 2010; Henri & Journeault, 2018; Shrivastava, 1995) and enhanced potential to attract and retain qualified employees (Dixon-Fowler et al., 2013; Russo & Fouts, 1997).

To conclude, it can be predicted that eco-production practices and eco-marketing practices have a positive relationship with environmental performance and economic performance. This leads to the following hypotheses:

H8a: Eco-production practices have a positive direct effect on environmental performance.

H8b: Eco-marketing practices have a positive direct effect on environmental performance.

H9a: Eco-production practices have a positive direct effect on economic performance.

H9b: Eco-marketing practices have a positive direct effect on economic performance.

Environmental Performance and Economic Performance

The study of the relationship between environmental performance and economic performance has yielded two contrasting opinions. The win-lose paradigm suggests that environmental investments lead to higher costs and lower profit (Burnett & Hansen, 2008; Henri & Journeault, 2010; Plaza-Úbeda et al., 2009; Schaltegger, 2011). For example, firms may spend more on pollution-control technologies; environmental engineers may need to spend more time on environmental projects; and plant workers probably would have additional workload to deal with recycled waste (Whitehead & Walley, 1994). Therefore, implementing eco-practices passes societal costs to the firms (Dixon-Fowler et al., 2013).

While a win-lose paradigm indicates that there is a negative relationship between environmental performance and economic performance, a win-win paradigm suggests a positive relationship. Literature on this paradigm has suggested that firms can achieve environmental performance while having economic benefits (Burnett & Hansen, 2008; Chen et al., 2006; Dixon-Fowler et al., 2013; Hart, 1995; Henri & Journeault, 2010; Pérez-Calderón et al., 2011; Porter & Van der Linde, 1995; Russo & Fouts, 1997; Schaltegger, 2011). Pollution represents the inefficient use of resources. Improving efficiency through enhanced environmental performance may reduce costs. Strong environmental performance can be viewed as representative of a firm's capabilities in regard to continuous innovation that leads to increased competitiveness (Puriwat & Hoonsopon, 2021), in terms of environmental reputation, social legitimacy, the ability to retain quality employees, and product differentiation (Dixon-Fowler et al., 2013).

Since this study predicts that the fit between predominantly competitive environmental strategic intent and the form of eco-control will lead to the strategic alignment of eco-practices, which will in turn, lead to enhanced environmental and economic performance, it is expected that a win-win situation is likely to occur. This leads to the following hypothesis:

H10: Environmental performance has a positive direct effect on economic performance.

RESEARCH METHODOLOGY

Sample Selection

This study aims to examine the appropriate form of eco-control for firms pursuing different environmental strategic intents. Data were collected using a web-based survey with managers of Thai firms operating in manufacturing industries. Sample firms were selected from industrial estates under the responsibility of the Industrial Estate Authority of Thailand (IEAT) (Industrial Estate Authority of Thailand, 2020). Manufacturing firms located in Ayutthaya, Prachin Buri, Chachoengsao, Chonburi, and Rayong provinces were selected for two reasons. Firstly, those Industry Estates (IE) account for most of the total IE area in Thailand. Secondly, the estates are the home of a wide range of major industries which are significant to the Thai economy (Lunkam, 2020).

Some manufacturing industries have more critical environmental impacts than others. Firms with greater environmental exposure may have a greater incentive to perform better due to the potential environmental costs. They tend to embed environmental concern into their activities than low-polluting firms (Henri & Journeault, 2018). Hence, firms operating in ten high-polluting industries were selected for this study. The high-polluting industries are (1) wood and wood products, (2) paper and pulp, (3) petroleum and coal products, (4) chemical products, (5) metal products, (6) machinery, (7) electronics, (8) automotive and compartments, (9) textiles, and (10) recycling (Christ & Burritt, 2013; Henri & Journeault, 2018; Mokhtar et al., 2016; Setthasakko, 2010; Suansawat, 2013; Ussahawanitchakit, 2017). The two-digit TSIC (Thailand Standard Industrial Classification) was used to derive a list of firms from the IEAT database (National Statistics Office Thailand, 2009). Total number of sample firms are 1,323 manufacturing firms.

The target respondents are those at management level who have comprehensive knowledge about the firm's environmental strategy, MCSs, and environmental and economic performance. They must be fluent in Thai to understand and complete the questionnaire.

Survey design

Before administering the survey, the questionnaire was translated from English to Thai by a bilingual expert. It was then reviewed by two academics and one practitioner to ensure the understandability of the questionnaire as well as the consistency of the items with the

construct definitions of the instrument (face validity) (Hair et al., 2009; Hazzi & Maldaon, 2015). The questionnaire was then approved by the Office of Research Ethics Review Committee for Research Involving Human Subjects at Chulalongkorn University before the survey was conducted. In the first section of the web-based survey, information of the study, including research objective, procedure, and confidential assurance are presented. The consent agreement is then shown. The respondent can choose to leave or to continue with the survey.

Telephone calls were made to 1,323 manufacturing firms as the first contact. The purpose of the first contact was to identify the most appropriate respondents. The objective of the study was then introduced to encourage participation. The respondents were informed that they would be asked about their firm's environmental strategy, MCSs, environmental activities, and performance. They were informed that it would take approximately 30 minutes to complete the questionnaire. They were also informed that personal and organisational information would not be revealed to the public. The results of the study would be presented in aggregate form. Despite the assurance, some respondents refused to participate in the survey. The reasons included the length of the questionnaire, confidential policy, and the respondents' distress from the COVID-19 pandemic, which has affected the Thai economy and industrial sectors since the beginning of 2020 (United Nations Thailand, June 2020). 537 email contacts were acquired from the first contact. 537 emails with the link of the web-based survey were sent out between September and November 2020. As a token of appreciation for participating in the study, a cutlery set made from wheat straw was sent to the address which was voluntarily given by the respondent. A reminder email was sent two-weeks after the first point of contact in order to increase the response rate (Muñoz-Leiva et al., 2010).

Measurement of Constructs

In this study, the measurement items are a seven-point Likert scale. The respondents were asked to indicate (1) the extent to which the integration of environmental aspects within their company is undertaken, (2) the extent to which they agree or disagree with the eco-control implementation aspects, (3) the extent to which they agree or disagree with the strategic alignment aspects, (4) the extent to which the eco-practices are implemented, (5) the environmental and economic performance of their company for the past three years compared to their competitors, and (6) firm characteristics such as firm size, public visibility, ISO14001 certification, being OBM, ODM, or OEM, and international ownership. The questions were

adopted from prior environmental studies as shown in Table 2. The concept of the circular economy (Bocken et al., 2016) is also introduced in the measurement items. Two constructs were adopted from MCS literature, namely, the bureaucratic forms of eco-control and the strategic alignment of eco-practices. The bureaucratic forms of eco-control were adopted from Auzair and Langfield-Smith (2005) by including (1) environmental performance measures, (2) environmental policies and procedures, and (3) environmental budgets. These eco-controls were selected because they are the most studied in MCS literature (Guenther et al., 2016; Henri & Journeault, 2010; Lueg & Radlach, 2016). The strategic alignment of eco-practices was adopted from Chenhall (2005) by classification into eco-production practices and eco-marketing practices[1]. A preliminary reliability test for each construct was performed using SPSS factor analysis. The reliability of all variables was acceptable as the Cronbach's alpha of all variables was greater than 0.70, except for the bureaucratic form of eco-control construct (Cronbach's alpha = 0.69) (Hair et al., 2009).

Table 2. Variable measurement of the main constructs

Variables		Adapted from	Number of items	Cronbach's alpha
Eco-efficiency intent	EFI	Bocken et al. (2016); Journeault et al. (2016)	5	0.844
Eco-branding intent	EBI	Bocken et al. (2016); Journeault et al. (2016)	4	0.893
Bureaucratic forms of eco-control	CTRL	Auzair and Langfield-Smith (2005); Henri and Journeault (2010)	3	0.690
Strategic alignment of eco-production practices	ALP	Chenhall (2005)	4	0.853
Strategic alignment of eco-marketing practices	ALM	Chenhall (2005)	4	0.948
Eco-production practices	EPP	Bocken et al. (2016); Journeault et al. (2016)	5	0.898
Eco-marketing practices	EMP	Bocken et al. (2016); Journeault et al. (2016)	7	0.931
Environmental performance	ENV	Henri and Journeault (2018); Suansawat (2013)	6	0.939
Economic performance	ECP	Henri and Journeault (2010)	5	0.938

Regression Model

In order to explore whether a firm's characteristics are associated with the degree of bureaucratic forms of eco-control (H1), a regression model is estimated as follows:

$$CTRL = \beta 0 + \beta 1EFI + \beta 2EBI + \beta 3SIZE + \beta 4PUBLIC + \beta 5ISO14001 + \beta 6OBM + \beta 7INTER + \varepsilon$$

[1] The questionnaire is shown in the Appendix of this dissertation.

The degree of bureaucratic forms of eco-control *(CTRL)*, eco-efficiency intent *(EFI)*, and eco-branding intent *(EBI)* are measured by a seven-point Likert scale (Table 2.). Firm size *(SIZE)* is measured by the number of employees. The number of employees is a dummy variable, where 1 means that a firm has more than 200 employees, 0 means that a firm has equal to or less than 200 employees. The cut-off number is 200 employees since firms which hire no more than 200 employees are defined as small and medium-sized enterprises (Pitchayadol et al., 2018; The Office of SMEs Promotion, 2020). The number of employees is used for three reasons. Firstly, the number of employees has been used as a proxy for firm size in most MCS literature. Secondly, it seems to be appropriate when eco-controls, which aim to alter individual behaviour to align with the firm's strategy, are studied. Lastly, the number of employees has been found to be associated with net assets (Chenhall, 2006). Public visibility measurement *(PUBLIC)* is a dummy variable, where 1 means that a firm or its parent company is listed on the stock exchange, 0 means that a firm or its parent company is a non-listed firm (Henri & Journeault, 2010). The environmental certification measurement *(ISO14001)* is a dummy variable, where 1 means that a firm is currently ISO 14001 certified, and 0 means that a firm is not currently ISO 14001 certified (Suansawat, 2013; Windolph et al., 2014). Being an original brand manufacturer (*OBM*) is a dummy variable, where 1 means that a firm is an OBM, and 0 means that a firm is an original equipment manufacturer (OEM) or an original design manufacturer (ODM). International ownership measurement *(INTER)* is a dummy variable, where 1 means that a firm is a subsidiary of an international firm, and 0 means that a firm is a local firm.

Predominant Environmental Strategic Intent and Bureaucratic Forms of Eco-control Classification

In order to classify firms by their predominant environmental strategic intent, the mean score of the eco-branding intent measurement was subtracted from the mean score of the eco-efficiency intent measurement to establish the importance of the predominance. A positive score reflects a predominantly eco-efficiency strategic intent firm, while a negative score reflects a predominantly eco-branding strategic intent firm. A multiple competitive environmental strategic intent firm is represented by zero difference.

The fit between competitive environmental strategic intent and the bureaucratic forms of eco-control is achieved when predominantly eco-efficiency strategic intent firms adopt more bureaucratic forms of eco-control (eco-controls > 4.00 point), while predominantly eco-branding strategic intent firms adopt less bureaucratic forms of eco-control (eco-controls < 4.00 point). Multiple competitive environmental strategic intent firms are suggested to adopt

moderate bureaucratic forms of eco-control (eco-controls = 4.00 point). Table 3. presents the fit between competitive environmental strategic intent and bureaucratic forms of eco-control.

Table 3.The fit between competitive environmental strategic intent and bureaucratic forms of eco-control

Competitive Environmental Strategic Intent	**Bureaucratic forms of eco-control**		
	More	**Moderate**	**Less**
Predominant eco-efficiency strategic intent	Fit	X	X
Predominant eco-branding strategic intent	X	X	Fit
Multiple competitive environmental strategic intents	X	Fit	X

Predominant Eco-practices Classification

In relation to the classification of firms according to their predominant eco-practices, the mean score of the eco-marketing practices measurement is subtracted from the mean score of the eco-production practices measurement to establish the major predominance. A positive score reflects a predominant eco-production practice implementation, while a negative score reflects a predominant eco-marketing practice implementation. Neutral eco-practice implementation is represented by zero difference.

The strategic alignment of eco-practices occurs when a predominantly eco-efficiency strategic intent firm adopts predominantly eco-production practices. A predominantly eco-branding strategic intent firm has strategic alignment of eco-practices when it adopts predominant eco-marketing practices. A multiple environmental strategic intent firm has strategic alignment of eco-practices when it adopts neutral eco-practices. Table 4. presents the strategic alignment of eco-practices.

Table 4. Strategic alignment of eco-practices

Competitive Environmental Strategic Intent	**Eco-practices**		
	Predominant eco-production practices	**Neutral Eco-practices**	**Predominant eco-marketing practices**
Predominant eco-efficiency strategic intent	Aligned	X	X
Predominant eco-branding strategic intent	X	X	Aligned
Multiple competitive environmental strategic intents	X	Aligned	X

Hypothesis Testing

Regression analysis was employed to test whether a firm's characteristics are associated with the degree of bureaucratic forms of eco-control (H1). The Mann-Whitney Test was performed to test whether firms adopting the bureaucratic forms of eco-control that match their competitive environmental strategic intent have higher level of strategic alignment of eco-

practices than firms adopting the bureaucratic forms of eco-control that do not match their competitive environmental strategic intents (H2). Lastly, Structural Equation Modeling (SEM) was employed to explore whether firms rely on eco-controls in translating competitive environmental strategic intents into eco-practices, which may lead to enhanced environmental and economic performance (H3 – H10).

RESULTS AND DISCUSSION

The Degree of Bureaucratic Forms of Eco-control

Out of 537 firms, 175 responses were received. Six responses were eliminated because of duplication (4) and incomplete data on key variables of interest (2). Therefore, 169 usable responses were received with a final response rate of 31.47%. The response rate is acceptable when compared with prior environmental management survey-based studies in Thailand (Suansawat, 2013) as suggested by Van der Stede et al. (2005). Appendix A. presents descriptive information about the samples. A nonresponse bias check was performed by comparing the key variables of interest, including firm size, public visibility, environmental certification (ISO14001), major activity, and international ownership of the first 30 responses and the last 30 responses (using late respondents as a proxy for non-respondents). The results of an independent samples t-test (not reported) show that there were no significant differences between any of the variables, except for environmental performance and economic performance where late responses were higher than those of early responses. Since survey data are based on self-reporting, common method bias (CMB) is of concern. CMB may occur when two or more variables of interest are collected from the same respondents and the researcher tries to identify correlations between them (Podsakoff & Organ, 1986). Harman's One Factor Test was used to detect common method variance (CMV), which is equivalent to the detection of CMB (Fuller et al., 2016). An un-rotated exploratory factor analysis, using the eigenvalue-greater-than-one criterion revealed that the first factor accounted for 36.25% of the variance among variables which is acceptable, as suggested in previous research (Fuller et al., 2016; Podsakoff et al., 2003). These tests indicate that there was no significant non-response bias or common method bias that affected the results of this study.

The first purpose of this study is to explore whether a firm's characteristics are associated with the degree of bureaucratic forms of eco-control. Out of 169 sample firms, the mean value for the degree of bureaucratic forms of eco-control (CTRL) was 5.696 (SD = 1.126). The one sample t-test (not shown) revealed that the mean value (5.696) was statistically significantly different from 4.00 with a mean difference of 1.696 (t = 19.580, $p < 0.01$). In addition, out of

169 firms, 151 firms (89.35%) had the degree of bureaucratic forms of eco-control more than the 4.00 point, which is the cutoff point of more bureaucratic forms of eco-control measurement. To enhance the reliability of the analysis, 18 firms that adopted less bureaucratic forms of eco-control (the degree of bureaucratic forms of eco-control equal or less than 4.00 point) were excluded. This leads to a final sample of 151 firms adopting more bureaucratic forms of eco-control (the degree of bureaucratic forms of eco-control more than 4.00 point) for further analysis. A sample size of 150 or more is acceptable for SEM analysis (Anderson & Gerbing, 1988). Table 5. Presents the number and percentage of responses received while Table 6. presents the number and percentage of firms for each predominant environmental strategic intent that adopted more bureaucratic forms of eco-control.

Table 5. Number and percentage of responses received

	Number of firms	**%**
Email send	537	100.00
Responses received	175	32.58
Less duplication	(4)	0.74
Less Incomplete key variables of interest	(2)	0.37
Useable responses	169	31.47
Less firms adopting less bureaucratic forms of eco-control	(18)	3.35
Firms adopting more bureaucratic forms of eco-control	**151**	**28.12**

Note: the numbers in parentheses are subtractions.

Table 6. Number and percentage of firms adopting more bureaucratic forms of eco-control classified by predominant environmental strategic intents

Competitive Environmental Strategic Intent	**Number of firms**	**%**
Predominant eco-efficiency strategic intent	42	28
Predominant eco-branding strategic intent	71	47
Multiple competitive environmental strategic intents	38	25
Total	**151**	**100**

Table 7. shows the regression results of the association between firm characteristics and the degree of bureaucratic forms of eco-control. Both eco-efficiency intent *(EFI)* and eco-branding intent *(EBI)* were found to have a positive association with more bureaucratic forms of eco-control ($\beta = 0.169$, $p < 0.05$ and $\beta = 0.366$, $p < 0.001$ respectively). This result indicates that the motivation for adopting more bureaucratic forms of eco-control come from eco-branding intent to a greater extent than those from eco-efficiency intent. As expected, firm characteristics, such as being ISO14001 certified *(ISO14001)*, and international ownership *(INTER)* had a positive association with more bureaucratic forms of eco-control ($\beta = 0.269$, $p < 0.001$, and $\beta = 0.135$, $p < 0.05$). In contrast, firm size *(SIZE)* was found to have a negative association with more bureaucratic forms of eco-control ($\beta = -0.171$, $p < 0.01$). It can

be said that big firms tend to relax eco-controls more than small firms. Contrary to expectations, Original Brand Manufacturers *(OBM)* had a positive association with more bureaucratic forms of eco-control ($\beta = 0.156$, $p < 0.05$). However, public visibility *(PUBLIC)* was not found to be associated with more bureaucratic forms of eco-control. Overall, firm characteristics were found to be associated with more bureaucratic forms of eco-control implementation; thus, H1 is supported.

Table 7. Regression results of the association between firm characteristics and the degree of bureaucratic forms of eco-control

	Intercept	**EFI**	**EBI**	**SIZE**	**PUBLIC**	**ISO14001**	**OBM**	**INTER**
Standardized Coefficients		0.169	0.366	-0.171	0.160	0.269	0.156	0.135
t-statistic	5.703***	2.103**	4.465****	-2.671***	0.252	4.015****	2.494**	2.094**

[a] Dependent Variable: Eco-controls, $R^2 = .459$, $F = 17.299$, p-value = .000

[b] Level of significance of $p < 0.10$, 0.05, 0.01, and 0.001 are denoted as *, **, ***, and **** respectively.

Based on empirical findings presented in Table 7, it appears that Thai manufacturing firms tend to adopt action, formal and tight controls regardless of their predominant competitive environmental strategies. The use of more bureaucratic forms of eco-control is motivated by the eco-branding intent to a greater extent than the eco-efficiency intent. This finding could help to explain why OBMs that produce own-brand products adopt more bureaucratic forms of eco-control than OEMs and ODMs. With ISO14001 certification, firms naturally adopt more bureaucratic forms of eco-control since ISO14001, which is commonly used as guideline for eco-controls, is a bureaucratic form (Morrow & Rondinelli, 2002; Virtanen et al., 2013). Subsidiaries of international firms were found to adopt more bureaucratic forms of eco-control than local firms. This may be because bureaucratic forms of control are designed to support technical operations, especially in international firms (Pucik & Katz, 1986). Surprisingly, small firms were found to adopt more bureaucratic forms of eco-control than large firms. One of the possible explanations is that small firms may have fewer resources than large firms (Rau et al., 2015; Verburg et al., 2018). They, therefore, need to employ more tight control for the most efficient use of resources. Another possible explanation is that CEOs in small firms who have high need for achievement tend to use more formal controls for quick operation feedback and control (Miller & Toulouse, 1986). Lastly, listed and non-listed firms are not different in terms of adopting more bureaucratic forms of eco-control since no statistically significant difference in the model was revealed for public visibility.

Although firms adopt more bureaucratic forms of eco-control regardless of their predominant competitive environmental strategic intents, the use of more bureaucratic forms of eco-control is motivated by eco-branding intent to a greater extent than by eco-efficiency intent. This

finding is not consistent with prior literature which revealed that firms focusing on eco-efficiency intent would rely more on eco-controls than eco-branding intent firms (Journeault et al., 2016). This inconsistent finding may be because Journeault et al. (2016) used levers of eco-control in their study while this study focuses on the degree of bureaucratic forms of eco-control.

The Fit Between Competitive Environmental Strategic Intent and Bureaucratic Forms of Eco-control

In order to test whether firms adopting the bureaucratic forms of eco-control that match their competitive environmental strategic intents have higher level of strategic alignment of eco-practices than firms adopting the bureaucratic forms of eco-control that do not match their competitive environmental strategic intents (H2), firms were classified by the fit between predominant competitive environmental strategic intent and bureaucratic forms of eco-control, as shown in Table 8. and Table 9. Firms classified by the strategic alignment of eco-practices are presented in Table 10. and Table 11.

Table 8. Number of firms classified by the fit between predominant competitive environmental strategic intents and bureaucratic forms of eco-control

Competitive Environmental Strategic Intent	Bureaucratic forms of eco-control			Total
	More	Moderate	Less	
Predominant eco-efficiency strategic intent	42*	0	0	42
Predominant eco-branding strategic intent	71	0	0	71
Multiple competitive environmental strategic intent	38	0	0	38
Total	**151**	**0**	**0**	**151**

*42 firms that have a fit between competitive environmental strategic intents and bureaucratic form of eco-controls

Table 9. Number and percentage of firm adoption of the bureaucratic forms of eco-control that fit and do not fit with their competitive environmental strategy

	Number of firms	%
Fit between competitive environmental strategic intent and bureaucratic forms of eco-control	42	28
Do not fit between competitive environmental strategic intent and bureaucratic forms of eco-control	109	72
Total	**151**	**100**

Table 10. Number of firms classified by the strategic alignment of eco-practices

Competitive Environmental Strategic Intent	Eco-practices			Total
	Predominant eco-production practices	Neutral Eco-practices	Predominant eco-marketing practices	
Predominant eco-efficiency strategic intent	20*	9	13	42
Predominant eco-branding strategic intent	35	8	28*	71
Multiple competitive environmental strategic intent	11	13*	14	38
Total	**66**	**30**	**55**	**151**

*61 firms that have strategic alignment of eco-practices

Table 11. Number and percentage of firms classified by the strategic alignment of eco-practices

	Number of firms	**%**
Strategic alignment of eco-practices	61	40
No strategic alignment of eco-practices	90	60
Total	**151**	**100**

The result from Mann-Whitney Test (not shown) revealed that there was no statistically significant difference in the median of strategic alignment of eco-practices between firms which adopt bureaucratic forms of eco-control that match their predominant competitive environmental strategic intents and firms which adopt bureaucratic forms of eco-control that do not match their predominant competitive environmental strategic intent ($t = -1.119$, $p = 0.263$). Thus, H2 is not supported. A possible explanation is that this study focuses on competitive environmental strategic intent as a contingent variable. However, adopting bureaucratic forms of eco-control may depend on other contingent variables which were not included in this study.

The Role of Eco-controls in Translating Intents into Practices

Structural Equation Modeling (SEM) was used to test H3 to H10 by exploring how eco-controls translate competitive environmental strategic intents into eco-production practices and eco-marketing practices, and whether such eco-practices lead to enhanced environmental and economic performance. Table 12. presents the descriptive statistics and Table 13. presents a correlation matrix (Pearson) of the constructs. The diagonal elements are the square roots of the average variance extracted (AVE).

Table 12. Descriptive statistics of the constructs (N=151)

Descriptive statistics	**EFI**	**EBI**	**CTRL**	**ALP**	**ALM**	**EPP**	**EMP**	**ENV**	**ECP**
Number of items	5	4	3	4	4	5	7	6	5
Minimum	3.600	3.000	4.333	3.250	2.000	1.000	1.143	1.167	1.600
Maximum	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000	7.000
Mean	6.114	6.181	5.974	5.858	5.685	5.638	5.584	5.419	4.776
Standard deviation	0.726	0.853	0.783	0.824	1.055	1.123	1.162	1.301	1.089
Median	6.200	6.250	6.000	6.000	6.000	5.800	6.000	5.833	5.000

Table 13. Correlation matrix (Pearson) of the constructs and squre root of AVE (on diagonal)

Correlation matrix (Pearson)	EFI	EBI	CTRL	ALP	ALM	EPP	EMP	ENV	ECP
EFI	0.743								
EBI	0.638***	0.806							
CTRL	0.454***	0.550***	0.654						
ALP	0.487***	0.546***	0.661***	0.764					
ALM	0.533***	0.473***	0.386***	0.664**	0.905				
EPP	0.317***	0.449***	0.303***	0.595***	0.441***	0.809			
EMP	0.458***	0.631***	0.485***	0.693***	0.644***	0.735***	0.809		
ENV	0.039	0.178**	0.177**	0.188**	0.175**	0.353***	0.389***	0.842	
ECP	0.182**	0.225***	0.258***	0.266***	0.181**	0.284***	0.387***	0.297***	0.859

[a]Level of significance of $p < 0.10$, 0.05, and 0.01 are denoted as *, **, ***, respectively. N = 151
[b]Diagonal elements are the square roots of the AVE. Off-diagonal elements are the correlations between the constructs.

Measurement Model

Appendix B. presents the results from the Confirmatory Factor Analyses (CFA) of the constructs. The output from AMOS revealed high (greater than 0.70) loadings for all items on their latent constructs, except for the bureaucratic forms of eco-control items (0.623-0.678) which may be acceptable. In addition, the high composite reliability measures for all latent variables (from 0.693 to 0.935) confirm the alpha scores by presenting acceptable construct reliability (Hair et al., 2009). The convergent validity of constructs was evaluated by employing the average variance extracted (AVE). The AVE for each variable was well above 0.50, except for the bureaucratic forms of eco-control (0.428), so convergent validity was demonstrated (Fornell & Larcker, 1981; Hair et al., 2009). In regard to discriminant validity, the square roots of AVE of all constructs were above the correlation with other constructs, except for the correlation between the bureaucratic forms of eco-control construct and the strategic alignment of eco-production practices construct (Table 13.). These attributes show that each latent construct explained more of the variance in their item measures than they shared with other constructs (Bedford & Speklé, 2018; Hair et al., 2009). Overall, all latent constructs exhibited adequate convergent validity and discriminant validity.

Structural Model

Structural Equation Modelling (SEM) was used to test the model. For the model fit, Root Mean Square Error of Approximation (RMSEA) is suggested to be less than 0.080 for the model absolute fit; the comparative fit index (CFI) is suggested to be greater than 0.900 for incremental fit; and Chi-square/degree of freedom (CMIN/DF) is suggested to be less than 2.000 for a parsimonious fit (Hair et al., 2009; Vanichbuncha, 2019). The original model presents an appropriate fit of RMSEA =0.070, CFI = 0.905, and CMIN/DF = 1.736 and the revised model presents the same RMSEA and CFI with CMIN/DF = 1.734. The difference

between the original model and the revised model was that the original model presented one direct path from CTRL to EPP and another direct path from CTRL to EMP, while these paths were removed in the revised model. The results of both models are shown in Table 14., and Figure 3. and Figure 4. show the original model and the revised model, respectively.

For hypothesis testing, eco-efficiency intent had no direct effect on eco-production practices in both the original and the revised model. In contrast, a positive direct effect of eco-branding intent on eco-marketing practices was found in both the original model ($\beta = 0.176$, $p < 0.10$) and the revised model ($\beta = 0.207$, $p < 0.10$). Thus, H3a is not supported whereas H3b is supported.

Eco-efficiency intent had no direct effect on more bureaucratic forms of eco-control in the original model while a positive direct effect was found in the revised model ($\beta = 0.319$, $p < 0.10$). On the other hand, Eco-branding intent had a positive direct effect on more bureaucratic forms of eco-control in the original model ($\beta = 0.527$, $p < 0.01$) and the revised model ($\beta = 0.557$, $p < 0.01$). Thus, H4a is supported only in the revised model whereas H4b is supported in both models.

More bureaucratic forms of eco-control had no direct effect on eco-production practices or eco-marketing practices in the original model. Thus, H5a and H5b are not supported. However, more bureaucratic forms of eco-control had a positive direct effect on the strategic alignment of eco-production practices in the original model ($\beta = 0.723$, $p < 0.001$) and the revised model ($\beta = 0.773$, $p < 0.001$). Furthermore, more bureaucratic forms of eco-control had a positive direct effect on the strategic alignment of eco-marketing practices in the original model ($\beta = 0.586$, $p < 0.001$) and the revised model ($\beta = 0.740$, $p < 0.001$). Thus, H6a and H6b are supported.

The strategic alignment of eco-production practices had a positive direct effect on eco-production practices in the original model ($\beta = 0.855$, $p < 0.001$) and the revised model ($\beta = 0.680$, $p < 0.001$). The strategic alignment of eco-marketing practices had a positive direct effect on eco-marketing practices in the original model ($\beta = 0.397$, $p < 0.001$) and the revised model ($\beta = 0.409$, $p < 0.001$). Therefore, H7a and H7b are supported.

Eco-production practices had no direct effect on environmental performance or economic performance in the original model or the revised model, hence, H8a and H9a are not supported. Nevertheless, eco-marketing practices had a positive direct effect on environmental performance in the original model ($\beta = 0.414$, $p < 0.05$) and the revised model

($\beta = 0.418$, $p < 0.05$). Furthermore, eco-marketing practices had a positive direct effect on economic performance in the original model ($\beta = 0.537$, $p < 0.01$) and the revised model ($\beta = 0.540$, $p < 0.01$). Thus, H8b and H9b are supported. Finally, environmental performance had a positive direct effect on economic performance in the original model ($\beta = 0.147$, $p < 0.10$) and the revised model ($\beta = 0.148$, $p < 0.10$); hence, H10 is supported. The unexpected result shows that eco-production practices were found to have a positive direct effect on eco-marketing practices in the original model ($\beta = 0.522$, $p < 0.001$) and the revised model ($\beta = 0.504$, $p < 0.001$).

Table 14. Standardised results of the structural equation modeling

Hypotheses	Relationships			Original Model[b]			Revised Model[c]		
				Standardized Coefficient	t statistics	Results	Standardized Coefficient	t statistics	Results
H3a	EFI	→	EPP	0.150	1.000	Not supported	-0.008	-0.091	Not supported
H3b	EBI	→	EMP	0.176	1.652*	Supported	0.207	3.351****	Supported
H4a	EFI	→	CTRL	0.323	1.576	Not supported	0.319	1.753*	Supported
H4b	EBI	→	CTRL	0.527	2.611***	Supported	0.557	3.016***	Supported
H5a	CTRL	→	EPP	-0.327	-1.638	Not supported	Not estimated		
H5b	CTRL	→	EMP	0.046	0.345	Not supported	Not estimated		
H6a	CTRL	→	ALP	0.723	4.339****	Supported	0.773	4.526****	Supported
H6b	CTRL	→	ALM	0.586	3.437****	Supported	0.740	3.999****	Supported
H7a	ALP	→	EPP	0.855	6.574****	Supported	0.680	6.758****	Supported
H7b	ALM	→	EMP	0.397	5.833****	Supported	0.409	6.933****	Supported
H8a	EPP	→	ENP	0.138	0.855	Not supported	0.130	0.880	Not supported
H8b	EMP	→	ENP	0.414	2.257**	Supported	0.418	2.287**	Supported
H9a	EPP	→	ECP	-0.082	-0.538	Not supported	-0.087	-0.621	Not supported
H9b	EMP	→	ECP	0.537	2.902***	Supported	0.540	2.916***	Supported
H10	ENP	→	ECP	0.147	1.753*	Supported	0.148	1.762*	Supported
Not hypothesised	EPP	→	EMP	0.522	8.126****		0.504	7.997****	

[a] Level of significance of $p < 0.10$, 0.05, 0.01, and 0.001 are denoted as *, **, ***, and **** respectively.
[b] Goodness-of-fit indices for the original model: RMSEA = 0.070; CFI = 0.905; CMIN/DF = 1.736
[c] Goodness-of-fit indices for the revised model: RMSEA = 0.070; CFI = 0.905; CMIN/DF = 1.734

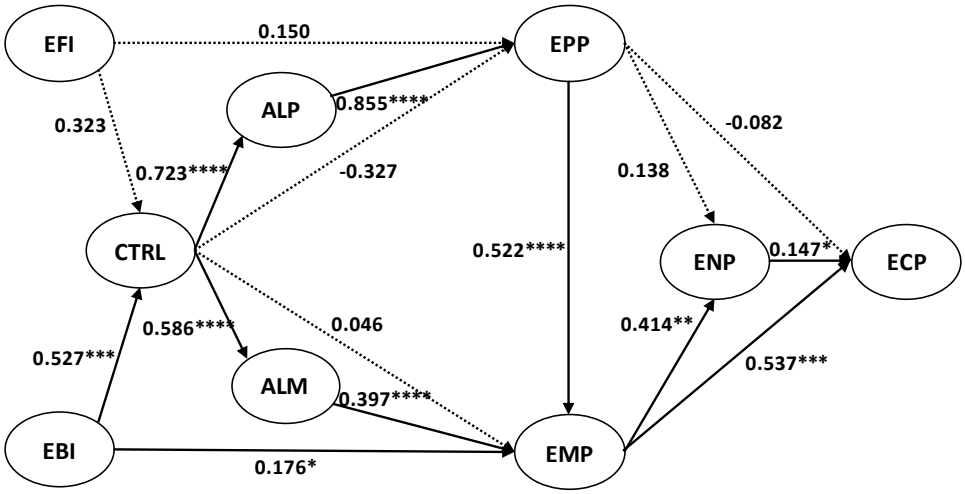

Figure 3. The original model

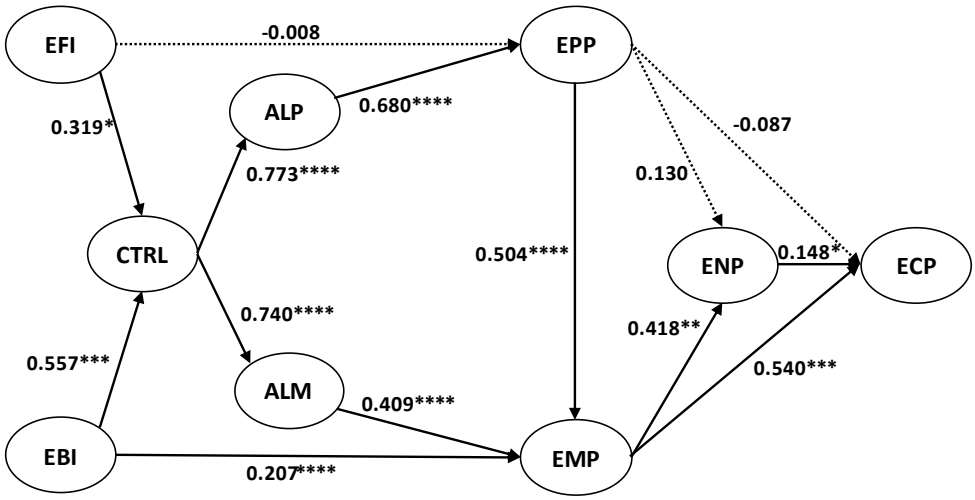

Figure 4. The revised model

H5a and H5b are not supported while H6a, H6b, H7a, and H7b are supported, which indicates that the strategic alignment of eco-practices fully mediates the relationship between more bureaucratic forms of eco-control and eco-practices. Specifically, the strategic alignment of

eco-production practices fully mediates the relationship between more bureaucratic forms of eco-control and eco-production practices, while the strategic alignment of eco-marketing practices fully mediates the relationship between more bureaucratic forms of eco-control and eco-marketing practices. Table 15. presents the direct and indirect effects of more bureaucratic forms of eco-control on eco-production practices and eco-marketing practices in the original model and the revised model.

Table 15. Direct and indirect effects of more bureaucratic forms of eco-control on eco-production practices and eco-marketing practices in the original model and the revised model

	Original Model (Direct and Indirect Effects)	**Revised Model (Only Indirect Effects)**
Effect of CTRL → EPP		
Total effects	0.291	0.526
Direct effects	-0.327	Not estimated
Indirect effects	0.618	0.526
Effect of CTRL → EMP		
Total effects	0.430	0.567
Direct effects	0.046	Not estimated
Indirect effects	0.384	0.567

Eco-efficiency intent was not found to have a direct effect on eco-production practices while eco-branding intent had a positive direct effect on eco-marketing practices. By adopting more bureaucratic forms of eco-control, firms can translate their multiple intents into eco-practices through two indirect paths. First, eco-efficiency intent is translated into eco-production practices through more bureaucratic forms of eco-control and the strategic alignment of eco-production practices. Second, eco-branding intent is translated into eco-marketing practices through more bureaucratic forms of eco-control and the strategic alignment of eco-marketing practices. Although previous literature proposed that eco-controls are related to eco-practices (Henri & Journeault, 2018; Journeault et al., 2016), only indirect paths were found in this study. In other words, the strategic alignment of eco-practices fully mediates the relationship between more bureaucratic forms of eco-control and eco-practices in our sample firms. These indirect paths show that more bureaucratic forms of eco-control were found to have the ability to transform both eco-efficiency intent and eco-branding intent into actions even though the two environmental strategic intents have distinct purposes.

The unexpected finding is that eco-production practices were found to have a positive direct effect on eco-marketing practices. It can be implied that firms may firstly implement eco-production practices to lower the environmental impact and to produce environmentally-friendly products, and then employ eco-marketing practices to attract green consumers and

increase revenue. It confirms prior literature that eco-branding intent may depend on both eco-production practices and eco-marketing practices to achieve its purpose (Journeault et al., 2016).

In relation to firm performance, eco-production practices were found not to have a direct effect on environmental and economic performance. Nevertheless, eco-marketing practices were found to have a positive direct effect on environmental and economic performance. Thus, the effect of eco-production practices on environmental and economic performance is an indirect path through eco-marketing practices. Lastly, environmental performance had a positive direct effect on economic performance. Hence, it can be argued that a win-win situation (i.e., the situation where firms can achieve both environmental and economic performance) can be realised through the direct effect of eco-marketing practices and the indirect effect of eco-production practices.

Additional Analysis

There are two additional analyses. The first analysis is to test whether firms adopting the bureaucratic forms of eco-control that match their competitive environmental strategic intents have higher level of strategic alignment of eco-practices than firms adopting the bureaucratic forms of eco-control that do not match their competitive environmental strategic intents (H2). with an alternative measurement. The second analysis is to compare environmental and economic performance at the sample firms.

First, in order to explore whether there is a difference between the strategic alignment of eco-practices, two groups of firms were identified. The first group consisted of firms adopting the bureaucratic forms of eco-control that match their predominantly competitive environmental strategic intents while the second group consisted of firms adopting the bureaucratic forms of eco-control that do not match their predominantly competitive environmental strategic intent. The classification of the two groups involved the same procedure as in the main analysis by matching firms' predominantly competitive environmental strategic intent with the bureaucratic forms of eco-control (Table 3.). The numbers and percentages of firms adopting the bureaucratic forms of eco-control that match and do not match their competitive environmental strategy are presented in Table 9. Next, instead of classifying firms that have a strategic alignment of eco-practices by matching their predominant environmental strategic intent with their predominant eco-practices, this additional analysis identified the strategic alignment of eco-production practices (ALP) and the strategic alignment of eco-marketing

practices (ALM) from the mean values of the measurement items indicated by the respondents.

An Independent-samples t-test was employed (not shown) to test whether there was a difference between the mean value of the strategic alignment of eco-practices based on the responses, ALP and ALM, for the two groups of firms (match versus do not match). The findings reveal that there was no statistically significant difference in the strategic alignment of eco-production practices based on the responses (ALP) ($t = -1.442$, $p = 0.152$) and the strategic alignment of eco-marketing practices based on the responses (ALM) ($t=1.564$, $p = 0.120$) between firms with the matching bureaucratic forms of eco-control and firms with the unmatching bureaucratic forms of eco-control. This confirms the result of the main analysis that H2 is not supported.

The second additional analysis compares environmental and economic performance at the sample firms. First, firms were classified into those with the value above or below the mean value of each construct based on the responses. Environmental performance and economic performance were then compared for the two groups. The results from second additional analysis reveals that firms adopting more bureaucratic forms of eco-control above the mean value had the same level of environmental performance as those adopting more bureaucratic forms of eco-control below the mean value. In contrast, the economic performance of firms adopting more bureaucratic forms of eco-control above the mean value was higher than firms adopting more bureaucratic forms of eco-control below the mean value ($t = 2.737$, $p < 0.01$). Firms with a strategic alignment of eco-production practices above the mean value had the same level of environmental and economic performance as firms with a strategic alignment of eco-production practices below the mean value. The environmental and economic performance of firms with a strategic alignment of eco-marketing practices above the mean value was higher than those of firms with a strategic alignment of eco-marketing practices below the mean value ($t = 2.034$, $p < 0.05$ and $t = 3.112$, $p < 0.01$, respectively).

In regard to eco-practices implementation, firms adopting eco-production practices above the mean value had a higher level of environmental and economic performance when compared to firms adopting eco-production practices below the mean value ($t = 3.770$, $p < 0.001$ and $t = 4.896$, $p < 0.001$, respectively). In addition, firms adopting eco-marketing practices above the mean value had a higher level of environmental and economic performance than firms adopting eco-marketing practices below the mean value ($t = 2.773$, $p < 0.01$ and $t = 4.912$, $p < 0.001$, respectively). Lastly, the economic performance of firms with environmental

performance above the mean value was higher than that of firms with environmental performance below the mean value ($t = 3.438$, $p < 0.05$). Therefore, it can be implied that adopting a high degree of bureaucratic forms of eco-control and having a high degree of strategic alignment of eco-practices and eco-practice implementation influences a firm's environmental and economic performance. Table 16. presents the results of the independent-samples t-test that compares environmental performance and economic performance.

Table 16. The comparison of environmental and economic performance for firms with a value above and below the mean value of each construct based on the responses

Constructs	No. of Firms	%	Environmental Performance		Economic Performance	
			t statistic	Mean diff.	t statistic	Mean diff.
Bureaucratic forms of eco-control			1.199	0.2476	2.737***	0.4820
Above the mean value	88	58				
Below the mean value	63	42				
Total	151	100				
Strategic alignment of eco-production practices			1.011	0.2157	1.180	0.2107
Above the mean value	85	56				
Below the mean value	66	44				
Total	151	100				
Strategic alignment of eco-marketing practices			2.034**	0.4342	3.112***	0.5535
Above the mean value	94	62				
Below the mean value	57	38				
Total	151	100				
Eco-production practices			3.770****	0.8182	4.896****	0.8288
Above the mean value	92	61				
Below the mean value	59	39				
Total	151	100				
Eco-marketing practices			2.773***	0.5839	4.912****	0.8243
Above the mean value	89	59				
Below the mean value	62	41				
Total	151	100				
Environmental performance			N/A	N/A	3.438**	0.6144
Above the mean value	97	64				
Below the mean value	54	36				
Total	151	100				

[a] Level of significance of $p < 0.10$, 0.05, 0.01, and 0.001 are denoted as *, **, ***, and **** respectively.
[b] N/A = Not applicable

CONCLUSION

The purpose of this study was threefold: (1) to explore whether firm characteristics are associated with the degree of bureaucratic forms of eco-control; (2) to explore whether firms adopting the bureaucratic forms of eco-control that match their environmental strategy have a strategic alignment of eco-practices; and (3) to explain how competitive environmental strategic intents are translated into eco-practices, and whether this will, in turn, lead to

enhanced environmental and economic performance. A web-based survey was conducted to collect data from 151 manufacturing firms in the Central and Eastern Industries Estates in Thailand from September to November 2020. There are three main findings in this study. Firstly, firms tended to adopt more bureaucratic forms of eco-control (action control, formal control, tight control) than less bureaucratic forms of eco-control (result control, informal control, loose control) regardless of their competitive environmental strategic intents. Firm characteristics, such as ISO14001 certification, being an original branding manufacturer (OBM), and being an international firm, had positive relationships with more bureaucratic forms of eco-control, while firm size was found to have a negative association. Secondly, although the adoption of more bureaucratic forms of eco-control was motivated by an eco-branding intent to a greater extent than by an eco-efficiency intent, more bureaucratic forms of eco-control can translate competitive environmental strategic intents into eco-production practices and eco-marketing practices through the mediators. Specifically, the strategic alignment of eco-production practices fully mediates the relationship between more bureaucratic forms of eco-control and eco-production practices. In addition, the strategic alignment of eco-marketing practices fully mediates the relationship between more bureaucratic forms of eco-control and eco-marketing practices. Lastly, win-win situation, in which firms achieve enhanced environmental and economic performance, is driven by the direct effect of eco-marketing practices, the indirect effect of eco-production practices, and the adoption of more bureaucratic forms of eco-control.

This study contributes to strategy and management control literature by establishing the role of more bureaucratic forms of eco-control in predominantly eco-efficiency strategic intent firms, predominantly eco-branding strategic intent firms, and multiple competitive environmental strategic intent firms. Similar to Journeault et al. (2016), this study explicitly distinguished between intended environmental strategy and realised environmental strategy. This study extends Journeault et al. (2016) by also examining eco-controls in firms displaying both eco-efficiency and eco-branding strategic intents to the same level. In addition, this study has identified the relationship between more bureaucratic forms of eco-control and eco-practices through the strategic alignment of eco-practices, and its effect on environmental and economic performance. Further, while extant literature measures eco-controls based on a levers of control framework (Arjaliès & Mundy, 2013; Heggen & Sridharan, 2020; Journeault et al., 2016; Martyn et al., 2016) or MCS package (Guenther et al., 2016; Henri & Journeault, 2018; Lueg & Radlach, 2016), this study measured eco-controls in the multi-dimensional

continuum of the bureaucratic forms of eco-control (Auzair & Langfield-Smith, 2005) which provides an alternative measurement for MCS literature.

This study provides three practical implications. The first implication is that more bureaucratic forms of eco-control (i.e., action control, formal control, tight control) are suggested regardless of competitive environmental strategy since it is linked to environmental and economic performance through the strategic alignment of eco-practices. More bureaucratic forms of eco-control can be implemented to create a strategic alignment of eco-practices in several ways. First, it is important to make sure that environmental policies, rules, and procedures are written and communicated formally to all staff to facilitate formal control. Second, environmental performance indicators that are process-oriented may be adopted to monitor staff decisions and action on an ongoing basis for action control. For example, firms can apply the ratio of strategic decisions made when considering environmental issues in relation to the total number of decisions, the investment ratio in environmental-oriented technology research and development projects in relation to the total number of R&D projects, the degree of value chain partners' involvement in improving the environmental performance of products, the integration level of environmental issues into marketing methods and tools, and the number of employees properly trained or capable of using eco-design methods and tools (Rodrigues et al., 2017). Finally, in regard to tight control, Material Flow Cost Budgeting, which estimates material flows and related costs for the next period, and Material Flow Investment Appraisal, which considers the net present value of expected future material flow costs could be adopted to reach the desired targets and can be used to closely monitor eco-efficiency progress (Schaltegger & Zvezdov, 2015).

The second implication is derived from the positive association between more bureaucratic forms of eco-control and ISO14001. In addition, the eco-controls conform to some of the ISO14001 requirements (Arjaliès & Mundy, 2013). Therefore, ISO14001 certification is recommended.

The third implication is that eco-labelling, such as green or carbon labelling, is recommended. As an indirect path from eco-production practices to environmental and economic performance through eco-marketing practices was found, eco-labelling can be considered as one of the eco-marketing practices which reflects and communicates eco-efficiency practices in the production process.

The findings of this study should be treated with caution since this study has some limitations. First, this study investigates only the influence of competitive environmental strategic intents and firm characteristics on the bureaucratic forms of eco-control adoption. Future research may add other contingent variables, for example, perceived stakeholders' concern, top management's environmental commitment (Banerjee et al., 2003; Lisi, 2015), perceived ecological environmental uncertainty (Pondeville et al., 2013), and business strategy (Simons, 1990) to acquire an insight into the variables that may influence the bureaucratic forms of eco-control implementation. Second, new instruments were developed to measure the bureaucratic forms of eco-control and the strategic alignment of eco-practices. Although the instruments exhibited convergent validity, discriminant validity was a matter of concern. Future research may refine the instrument to enhance its validity (Bedford & Speklé, 2018).

Acknowledgements

The authors gratefully acknowledge the financial support from The 90th Anniversary of Chulalongkorn University Fund (Ratchadaphiseksomphot Endowment Fund).

Appendix A. Descriptive information of the samples (N=151)

	Number	%
Industry		
Wood and wood products	2	2
Paper and pulp	8	5
Petroleum and coal products	6	4
Chemical products	24	16
Metal products	21	14
Machinery	14	9
Electronics	23	15
Automotive and compartments	40	26
Textiles	6	4
Recycling	6	4
Other	1	1
Total	**151**	**100**
Department of respondents		
Environment/Safety/TQM	68	45
Production	20	13
HR/Accounting/Marketing/Management	63	42
Total	**151**	**100**
Position of respondents		
MD/CEO	7	5
Manager	89	59
Staff	55	36
Total	**151**	**100**
Number of employees		
Not exceed 200 employees	97	64
More than 200 employees	54	36
Total	**151**	**100**
Firm Status		
Listed firms	29	19
Non-listed firms	122	81
Total	**151**	**100**
ISO14001 certified		
Yes	91	60
No	60	40
Total	**151**	**100**
Major activity		
OBM	36	24
OEM/ODM	115	76
Total	**151**	**100**
International Ownership		
International firm	83	55
Local firm	68	45
Total	**151**	**100**

Note: The initial usable sample was 169 firms but for concrete analysis, 18 firms that adopted less bureaucratic forms of eco-control were removed. The final sample was 151 firms that adopted more bureaucratic forms of eco-control.

Appendix B. The results from confirmatory factor analysis (CFA)

Items	Descriptions	Standardised Factor Loading	Composite Reliability (CR)	Average Variance Extracted (AVE)
	Eco-efficient intent		0.879	0.552
EFI1	Increasing production efficiency	0.657		
EFI2	Reducing costs related to energy and material consumption	0.868		
EFI3	Reducing costs related to waste management	0.822		
EFI4	Reducing the risk of environmental liabilities and disasters	0.589		
EFI5	Extending natural resources and product value for a circular economy	0.742		
	Eco-branding intent		0.883	0.649
EBI1	Responding to the green market need	0.757		
EBI2	Providing high quality products with low environmental impact	0.911		
EBI3	Providing environmental advantages of the product compared to competing conventional products	0.800		
EBI4	Gaining emotional durability, attachment, and trust from green consumers	0.743		
	Bureaucratic forms of eco-control		0.693	0.428
CTRL1	Rather than focusing on the attainment of the environmentally desired targets, monetary and non-monetary environmental performance measures are used to monitor staff decisions and action on an ongoing basis	0.661		
CTRL2	Written rules, policies, procedures, and targets related to environmental aspects are communicated formally to all staff	0.678		
CTRL3	Budgets for environmental expenses and investment are very detailed	0.623		
	Strategic alignment of eco-production practices		0.851	0.584
ALP1	Links between environmental strategy and production policy are clearly formulated	0.713		
ALP2	Links between environmental strategy and production policy are pursued	0.751		
ALP3	Investments in production are screened for consistent with environmental strategy	0.742		
ALP4	Production activities are consistent with environmental strategy	0.845		
	Strategic alignment of eco-marketing practices		0.935	0.819
ALM1	Links between environmental strategy and marketing policy are clearly formulated	0.869		
ALM2	Links between environmental strategy and marketing policy are pursued	0.924		
ALM3	Investments in marketing are screened for consistent with environmental strategy	0.886		
ALM4	Marketing activities are consistent with environmental strategy	0.941		

Appendix B. The results from confirmatory factor analysis (CFA) (*continued*)

Items	Descriptions	Standardised Factor Loading	Composite Reliability (CR)	Average Variance Extracted (AVE)
	Eco-production practices		0.839	0.654
EPP1	Redesigning the product and process to reduce the use of energy and materials (e.g., alternative materials or components, cleaner production)	0.777		
EPP2	Redesigning the product and process to reduce emissions and waste	0.815		
EPP3	Redesigning the product and process to eliminate any potential environmental problems	0.909		
EPP4	Redesigning the product and process for ease of disassembly, material separation, and reassembly	0.797		
EPP5	Using waste outputs form one process into feed stock for another process or turn into new forms of value	0.734		
	Eco-marketing practices		0.877	0.654
EMP1	Surveillance of the market for environmental opportunities	0.891		
EMP2	Sponsorship of the environmental events	0.808		
EMP3	Use of environmental arguments in marketing (e.g., environmental advantages)	0.882		
EMP4	Making the product more appealing to green consumers (e.g., use of recycled, recyclable, and certified raw materials)	0.839		
EMP5	Applying a non-consumerist approach to sales (e.g., not over-selling, no sales commissions)	0.742		
EMP6	Collaboration with stakeholders to address and solve environmental problems and issues	0.820		
EMP7	Voluntary disclosure of a firm's environmental management and impacts	0.651		
	Environmental performance		0.883	0.709
ENP1	Waste management	0.770		
ENP2	Water management	0.861		
ENP3	Air emission control	0.947		
ENP4	Noise management	0.920		
ENP5	Smell management	0.914		
ENP6	Energy management	0.589		
	Economic performance		0.905	0.738
ECP1	Market share	0.725		
ECP2	Total revenue	0.803		
ECP3	Cash flow from operations	0.92		
ECP4	Operating profits	0.939		
ECP5	Return on investment (ROI)	0.891		

THE RELATIONSHIP BETWEEN CIRCULAR ECONOMY PRACTICES AND ECONOMIC PERFORMANCE: A STUDY OF MANUFACTURING FIRMS

Kanya Sannamwong[1], Wila-sini Wongkaew[1]*, and Danupol Hoonsopon[1]

[1]Chulalongkorn Business School, Chulalongkorn University,
254 Phyathai Road, Pathumwan District, Bangkok 10330

*Corresponding author: wilasini@cbs.chula.ac.th

This article was accepted for publication (in Thai) in the Journal of Management Science Udon Thani Rajabhat University [ISSN: 2228-8031 (Print); 2697-5300 (Online)] (TCI Tier 2) Volume 3 Issue 3 (May – June 2021) Page 11-24.

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Kanya Sannamwong[1], Wila-sini Wongkaew[1]*, and Danupol Hoonsopon[1]

[1]Chulalongkorn Business School, Chulalongkorn University,
254 Phyathai Road, Pathumwan District, Bangkok 10330, Thailand.

*Corresponding author: wilasini@cbs.chula.ac.th

ABSTRACT

The purpose of this research is to study the relationship between circular economy practices and the economic performance of manufacturing firms in Thailand. To collect data, a web-based survey was used. Multiple regression analysis was employed to analyse data from 87 firms in high-polluting industries. The results show that circular supplies had a positive relationship with firms' economic performance at statistical significance level of 0.01. Therefore, firms may adopt circular supplies to strengthen their resource security and maintain a sustainable competitive advantage.

Keywords: circular economy, sustainability, competitive advantage,
economic performance, recycle

INTRODUCTION

Business organisations have become increasingly concerned with environmental issues. One-way consumption means that a natural resource is extracted, manufactured, distributed, consumed, and then eliminated (Thai Industrial Office, 2016). Inappropriate waste management may result in additional business costs, such as high procurement cost, environmental remediation cost, and environmental litigation cost. As one-way consumption and inappropriate waste management may lead to an increase in costs, the concept of the circular economy (CE) has received increasing attention from business organisations.

The concept of CE attempts to close the material loops by transforming waste from primary products into secondary products. This process will lead to a more efficient use of natural resources and will bring about sustainable competitive advantages (Mahakhant & Anuwattana, 2019; Zils, 2014). Operation practices based on the CE concept could be in the following forms (De los Rios & Charnley, 2017; Mahakhant & Anuwattana, 2019; Zink & Geyer, 2017):

(1) Circular design. Circular design involves a redesigning of a product for ease of disassembly and reassembly. For example, Phillips Health™ extended the product life of medical equipment by offering a pre-owned refurbished medical imaging product to its customers (De los Rios & Charnley, 2017). Circular design can prolong product life.

(2) Resource recovery. Resource recovery involves the transformation of waste or scrap from one process into materials for another process. For example, N15 Technology Co., Ltd operates under the concept of zero waste to landfill by transforming non-toxic waste from their office and factory into refuse derived fuel (RDF) (N15 Technology, n.d.). Resource recovery would reduce waste to landfill.

(3) Circular supplies. Circular supplies involves the use of recycled raw materials or recyclable raw materials to produce new products or "upcycling". For example, Moreloop Co.,Ltd. upcycles surplus fabric from garment factories by turning it into cloth, bags, face masks and so on (Moreloop, n.d.). Bope Co.,Ltd. upcycles plastic waste into utensils such as coasters, bags, vases, furniture and so on (Pimpila, 2020). Circular supplies can add value to waste.

(4) Encourage sufficiency. Encouraging sufficiency involves offering high quality and durable products which would extend the product life. In addition, firms may not 'over-sell' or there is no sales commission policy (Bocken et al., 2016). For example, the outdoor clothing and equipment manufacturer and retailer, Patagonia®, launched the campaign "DON'T BUY THIS JACKET" to remind the customer to think before buying a new jacket. It included details on how natural resources were used and how the environment was impacted by making the product. This campaign reflected the concept of the 'non-consumerist of Patagonia®' and received attention from green customers. Thus, Patagonia® made more profit as highlighted by the founder, Yvon Chouinard:

"I know it sounds crazy, but every time I've made a decision that's best for the planet, I've made money." (Chouinard, n.d. as cited in Farré, 2020).

Previous literature has proposed that CE practices would yield better economic performance from cost savings in materials, energy, and waste management (Burnett & Hansen, 2008; Chen et al., 2006; Journeault et al., 2016; Virtanen et al., 2013). Sustainable competitive

advantage may also be achieved by increasing revenue and profit from the green market (Banerjee et al., 2003; Chen et al., 2006; Journeault et al., 2016). However, it is also possible that CE practices may bring additional cost for businesses (Plaza-Úbeda et al., 2009). While De los Rios and Charnley (2017) examined European manufacturing firms which had successfully implemented CE practices, their study did not investigate the association between CE practices and economic performance. In addition, the firms in their study implemented only a certain CE practice. How multiple CE practices affect economic performance and which specific CE practice has a high impact on economic performance are left unexplored. To address this gap, this study aims to investigate the relationship between four CE practices and economic performance. The findings from this study would add to literature by providing empirical evidence on the association between CE practices and economic performance in manufacturing firms. The conceptual model of this study is presented in Figure 5.

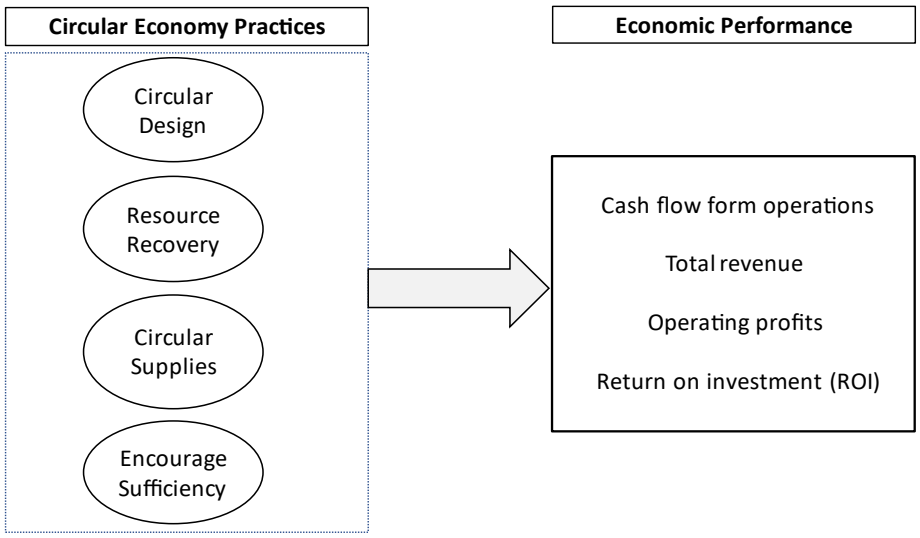

Figure 5. The conceptual model of the relationship between CE practices and economic performance

RESEARCH HYPOTHESES

This study expects that there is a relationship between circular economy practices and a firm's economic performance. This leads to the following hypotheses:

H1: Circular design has an association with economic performance.

H2: Resource recovery has an association with economic performance.

H3: Circular supplies has an association with economic performance.

H4: Encouraging sufficiency has an association with economic performance.

RESEARCH METHODOLOGY

Research Design

To address the research objective, data were collected by a web-based survey administered to managers of firms operating in manufacturing industries. Manufacturing firms located in the industrial estates (IE) under the responsibility of the Industrial Estate Authority of Thailand (IEAT) (Industrial Estate Authority of Thailand, 2020) were selected. Firms located in Prachin Buri, Chachoengsao, Chonburi, and Rayong province were selected because the Eastern IE is the home to a wide range of major industries which are in significant sectors of the Thai economy (Lunkam, 2020). The samples in this study are manufacturing firms in high-polluting industries as they tend to implement CE practices more than low-polluting firms (Henri & Journeault, 2018). The high-polluting industries are in the following sectors: (1) paper and pulp, (2) petroleum and coal products, (3) chemical products, (4) metal products, (5) machinery, (6) electronics, (7) automotive and compartments, (8) textiles, and (9) recycling (Christ & Burritt, 2013; Henri & Journeault, 2018; Mokhtar et al., 2016; Setthasakko, 2010; Suansawat, 2013; Ussahawanitchakit, 2017). The two-digit TSIC (Thailand Standard Industrial Classification) (National Statistics Office Thailand, 2009) was used to obtain the list of 1,243 firms from the IEAT database.

The target respondents at the sample firms were contacted to invite them to participate in a web-based survey. They were expected to have knowledge about the firm's environmental practices and economic performance. In addition, they had to be fluent in Thai to understand and complete the questionnaire. Before administering the survey, the questionnaire was translated from English into Thai by a bilingual expert. Two academics and one practitioner reviewed the questionnaire to examine the face validity of the instrument (Hair et al., 2009; Hazzi & Maldaon, 2015). The instrument was approved by the Office of Research Ethics Review Committee for Research Involving Human Subjects of Chulalongkorn University before they were sent out. Telephone calls were made as the first contact to identify the most appropriate respondents and to obtain their email addresses. The total of 492 emails were sent out between September and October 2020. A reminder email was sent two-weeks after the first point of contact.

Out of 492 firms, 90 responses were received. Three responses were removed due from duplication or incomplete data. Therefore, 87 usable responses were received, at a final response rate of 17.68%. The response rate is acceptable since firms tend to have a confidentiality policy about their operations and performance (White & Luo, 2005). In addition, the Thai government declared a state of emergency due to the coronavirus outbreak from March 2020[2]. An economic recession affected the operation of Thai manufacturing firms. Employees were forced to reduce their working days and some were laid-off (Prachachat.net, 2020). This may have caused the respondents' distress and led to hesitation about participating in the survey. The descriptive information of the samples is presented in the appendix.

Measurement of Constructs

The first part of the questionnaire focuses on the respondents' work position and the firm's profile. The second part are the seven-point Likert scale measurement items on CE practices and economic performance, adapted from previous literature (Aragón-Correa, 1998; Bocken et al., 2016; De los Rios & Charnley, 2017; González-Benito & González-Benito, 2005; Journeault et al., 2016; Melnyk et al., 2003; Moraga et al., 2019). The respondents were asked to indicate the extent of CE practices in their firms and to compare the firms' economic performance in the last three years with the economic performance of their competitors. It should be noted that economic performance measurement is the mean value of the four indicators from self-reporting. Table 17. presents the CE practices and economic performance measurement items.

Table 17. CE practices and economic performance measurement items

Constructs	Items
Circular Design *(DESIGN)*	Redesigning the product and process for ease of disassembly, material separation, and reassembly.
Resource Recovery *(RECOVERY)*	Using waste outputs form one process into feed stock for another process or turn into new forms of value.
Circular Supplies *(SUPPLY)*	Making the product more appealing to green consumers (e.g., use of recycled, recyclable, and certified raw materials).
Encourage Sufficiency *(SUFFICIENCY)*	Applying non-consumerist approach to sales (e.g., not over-selling, no sales commissions).
Economic performance[a] *(FINPERF)*	Cash flow from operations Total revenue Operating profits Return on investment

[a] Economic performance measurement is the mean value of the four indicators from self-reporting.

[2] Declaration of an Emergency Situation in all areas of the Kingdom of Thailand. (2020, March 25). *Government Gazette*. No. 134 Section 69 G. page 1.

Multiple regression analysis was used to explore whether CE practices were associated with economic performance. The regression model was estimated as follows:

$$FINPERF = \beta 0 + \beta 1 DESIGN + \beta 2 RECOVERY + \beta 3 SUPPLY + \beta 4 SUFFICIENCY + \varepsilon$$

RESULTS AND DISCUSSION

Descriptive Statistics

Data from the survey were analysed using SPSS version 22. The Cronbach's alphas of CE practices measurement and economic performance measurement were 0.88 and 0.93, respectively. A Cronbach's alpha which is above 0.70 indicates that the measurements have an internal consistency reliability (Hair et al., 2009; Pasunon, 2014).

Table 18. presents the descriptive statistics on the level of CE practices implemented by the 87 sample firms. The findings show that firms adopted CE practices at a moderate level. Circular design was implemented at a mean of 5.29 (SD = 1.65) and resource recovery was implemented at a mean of 5.47 (SD = 1.67). While circular supplies was implemented at the lowest level among the four CE practices (mean = 5.11, SD = 1.85), encouraging sufficiency was implemented at the highest level (mean = 5.61, SD = 1.85). Finally, the economic performance of the sample firms in the past three years were at a similar level to that of their competitors.

Table 18. Descriptive statistics of the constructs (N=87)

Constructs	Theoretical range	Mean	Standard deviation	Median
Circular Design	1 - 7	5.29	1.65	6.00
Resource Recovery	1 - 7	5.47	1.67	6.00
Circular Supplies	1 - 7	5.11	1.85	6.00
Encouraging Sufficiency	1 - 7	5.61	1.85	6.00
Economic performance	1 - 7	4.65	1.15	4.75

Regression Results

To detect the possibility of a high correlation between the independent variables, SPSS output revealed that VIF was between 2.068 and 2.529, which is less than the cut-off value (10). Thus, multicollinearity is not likely to occur in this model (Durongwatana, 2015; Hair et al., 2009). Table 19. shows the regression results on the relationship between CE practices and economic performance. Circular supplies has a positive association with economic performance at statistical significance level of $p < 0.001$ ($t = 3.397$). Thus, H3 is supported. On the other hand, circular design, resource recovery, and encouraging sufficiency did not have statistically significant associations with economic performance. Therefore, H1, H2, and H4 are not supported.

Table 19. Regression results of the relationship between circular economy practices and economic performance

	Unstandardized Coefficients	Standard error	t
Intercept	3.549	0.344	10.310
Circular supplies	0.215	0.063	3.397***

[a]Dependent variable: Economic performance

([P]ttgcgroup, 2020)[b]F = 11.536, p = 0.001, R Square = 0.120, Adjusted R Square = 0.109

[c]Level of significance of $p < 0.10$, 0.05, 0.01, and 0.0001 are denoted as *,**,***, and ****, respectively.

Based on the empirical findings presented in Table 19., it appears that circular supplies, such as using recycled or recyclable materials, has an association with superior economic performance. Sustainable competitive advantages may come from the uniqueness of the products which attracts green customers and has low procurement costs since the materials are surplus from other manufacturers. For example, tonlé (Tonlé, n.d.) creates zero waste fashion from dead stock fabric and scrap from fast fashion manufacturers in Phnom Penh, Cambodia. Tonlé's products are popular in green markets, especially in the US and Japan (Buakamsri, 2019) While tonlé maximizes the usage of waste from other entities, Café Amazon circulates their waste by making furniture from coffee chaff (Pttgcgroup, 2020). These CE practices lead to enhanced economic performance from cost savings and a positive environmental image (Mahakhant & Anuwattana, 2019).

The association between circular design and economic performance was not found to be statistically significant. A possible explanation is that design for disassembly and reassembly may require additional investment in technology. Resource recovery was also found not to have a statistically significant relationship with economic performance. This may be because resource recovery may require a different procurement process, as well as waste separation processes (Whitehead & Walley, 1994) so; it may take a long period for firms to realize any economic benefits. Thus, a cross sectional study may not reveal the association between CE practices and economic performance.

In addition to circular design and resource recovery, encouraging sufficiency also had no statistically significant association with economic performance. It may result from the fact that most sample firms (75%) were original equipment manufacturers (OEMs) and original design manufacturers (ODMs). Their customers are not end-users; hence, green marketing such as encouraging sufficiency may not be the most efficient way to communicate the firm's environmental policy.

It should be noted that it is possible that other CE practices which are not included in this study may have associations with economic performance. Examples of these other CE practices include the utilization of co-working spaces (Mahakhant & Anuwattana, 2019) and Audi®'s car sharing, which helps lower the number of cars on the road (De los Rios & Charnley, 2017).

CONCLUSION

This study aims to explore the relationship between four CE practices and firms' economic performance. Data were collected from a web-based survey between September and October 2020. The 87 sample firms are manufacturing firms located in The Eastern Industrial Estates of Thailand. The findings show that only circular supplies was found to have a positive association with economic performance.

This study contributes to the CE literature by providing empirical evidence on the association between CE practices and economic performance (Lieder & Rashid, 2016), especially in small and medium-sized enterprises (SMEs) (Dey et al., 2020). The implication from the findings are that firms should use recycled or recyclable materials for their products in order to enhance resource sustainability. However, costs and benefits should also be considered in implementing CE practices (Plaza-Úbeda et al., 2009). To maintain brand loyalty, secondary products that are made from recycled materials must be good quality as primary products. Firms can distribute secondary products through the same channels to the same group of customers (Zink & Geyer, 2017). OEM and ODM firms are recommended to invest in research and development, and develop their own brands to gain a competitive advantage as a result of a product differentiation strategy (Chen et al., 2016). Further, firms may apply environmental management accounting tools, such as life cycle assessment (LCA) or material flow cost accounting, to evaluate environmental and economic benefits resulting from the adoption of CE practices. The appropriate application of relevant environmental management accounting tools can lead to better environmental decision making and management (Saisut et al., 2020). An implication for policy makers is that the regenerative use of resources in industry should be supported (Lieder & Rashid, 2016). In addition, waste separation should be promoted and conducted at origin to reduce procurement costs for business and disposal costs for the communities (Mahakhant & Anuwattana, 2019).

One limitation of this study is that, due to its cross-sectional nature, the study may not capture the connection between economic performance and CE practices which may take time to

become evident. Future research may adopt a longitudinal approach to explore the effects of CE practices on economic performance over a longer period. Furthermore, it is interesting to investigate the associations between other CE practices, such as platform sharing, and economic performance. Lastly, it could be beneficial to conduct a study which focuses on firms that have their own brands to further examine the relationship between encouraging sufficiency and economic performance.

Acknowledgements

The authors gratefully acknowledge the financial support from The 90th Anniversary of Chulalongkorn University Fund (Ratchadaphiseksomphot Endowment Fund).

Appendix: Descriptive information of the samples (N=87)

	number	%
Industry		
Paper and pulp	1	1
Petroleum and coal products	5	6
Chemical products	5	6
Metal products	15	17
Machinery	9	10
Electronics	14	16
Automotive and compartments	35	41
Textiles	1	1
Recycling	2	2
Total	**87**	**100**
Department of respondents		
Environment/Safety/TQM	58	67
Human Resource	16	18
Administration	9	10
Top Management	4	5
Total	**87**	**100**
Number of employees		
Not exceed 200 employees	54	62
More than 200 employees	33	38
Total	**87**	**100**
Firm Status		
Listed firms	21	24
Non-listed firms	66	76
Total	**87**	**100**
Currently ISO14001 certified		
Yes	66	76
No	21	24
Total	**87**	**100**
Major activity		
OBM	22	25
OEM/ODM	65	75
Total	**87**	**100**
International Ownership		
International firm	66	76
Local firm	21	24
Total	**87**	**100**

PART III

CONCLUSION

PART III

CONCLUSION

The first article, “Strategic alignment of eco-practices: The mediator of eco-controls in translating environmental strategy”, investigates the role of eco-controls in translating multiple competitive environmental strategic intents into eco-practices. A web-based survey was used to collect data from firms operating in high-polluting industries located in the Central and Eastern Industrial Estates of Thailand. Three main findings emerged. First, firms tend to apply more bureaucratic forms of eco-control (i.e., action control, formal control, tight control) than less bureaucratic forms of eco-control (i.e., result control, informal control, loose control) regardless of their environmental strategies. Regarding firm characteristics, being ISO 14001 certified, being an original brand manufacturer (OBM), and being an international firm, were found to have a positive relationship with the degree of bureaucratic forms of eco-control. On the other hand, firm size was found to have a negative association, which suggests that small firms tend to adopt more bureaucratic forms of eco-control than large firms. Second, the adoption of more bureaucratic forms of eco-control is driven by eco-branding intent to a greater extent than eco-efficiency intent. However, the translations are processed through a mediator, the strategic alignment of eco-practices. Specifically, the strategic alignment of eco-production practices fully mediates the relationship between more bureaucratic forms of eco-control and eco-production practices, while the strategic alignment of eco-marketing practices fully mediates the relationship between more bureaucratic forms of eco-control and eco-marketing practices. Finally, firms have superior environmental and economic performance as a result of the adoption of more bureaucratic forms of eco-control and eco-practices.

While the first article provided empirical evidence on the role of eco-controls in translating environmental strategic intents into eco-practices, the second article, “The relationship between four circular economy (CE) practices and economic performance: A study of manufacturing firms”, explored the relationship between CE practices and firms’ economic performance. As CE practices are part of eco-practices, the second article can be considered an extension of the first article. The findings from the second article revealed that among the four CE practices examined, only circular supplies had a positive association with economic performance. The other three CE practices (i.e., circular design, resource recovery, and encouraging sufficiency) were not found to have an association with economic performance.

The results from the two articles provide empirical evidence to support a win-win paradigm, that is, firms could maintain environmental performance as well as enhance economic performance by adopting eco-controls and eco-practices. The findings from the two articles provide contributions to the existing literature in management accounting and control, particularly environmental management control, as follows:

Firstly, this study contributes to strategy and management control literature by assessing the role of more bureaucratic forms of eco-control in predominantly eco-efficiency strategic intent firms, predominantly eco-branding strategic intent firms, and multiple competitive environmental strategic intents firms. Secondly, the separation between intended environmental strategy and realised environmental strategy responds to the call for additional research which distinguishes between intended and realised strategy (Langfield-Smith, 2006). Although Journeault et al. (2016) addressed the issue to certain extent, this study further extends Journeault et al. (2016) by examining firms which exhibit both eco-efficiency and eco-branding intents to the same level. Thirdly, this study has identified the relationship between more bureaucratic forms of eco-control and eco-practices through the strategic alignment of eco-practices, and its effect on environmental and economic performance. Lastly, this study provides an alternative measurement for MCS literature. While extant literature measures eco-controls based on the levers of control framework (Arjaliès & Mundy, 2013; Heggen & Sridharan, 2020; Journeault et al., 2016; Martyn et al., 2016) or MCSs package (Guenther et al., 2016; Henri & Journeault, 2018; Lueg & Radlach, 2016), this study measures eco-controls in a multi-dimensional continuum of bureaucratic forms of eco-control (Auzair & Langfield-Smith, 2005).

IMPLICATIONS

The findings of the study revealed several implications for manufacturing firms and policy makers. For manufacturing firms, based on the findings of the first article, it is suggested that management should adopt more bureaucratic forms of eco-control (i.e., action control, formal control, tight control) since it connects to environmental and economic performance through the strategic alignment of eco-practices. More bureaucratic forms of eco-control can be implemented to create the strategic alignment of eco-practices in several ways. First, for formal control, it is important to make sure that environmental policies, rules, and procedures are written and communicated formally to all staff. Second, environmental performance indicators that are process-oriented should be adopted to monitor staff decisions and actions

on an ongoing basis for action control. For example, firms can apply the ratio of strategic decisions made considering environmental issues in relation to the total number of decisions; the investment ratio in environmental-oriented technology research and development projects in relation to total number of R&D projects; the degree of value chain partners' involvement in improving the environmental performance of products; the integration level of environmental issues into marketing methods and tools, and the number of employees properly trained or capable of using eco-design methods and tools (Rodrigues et al., 2017). Finally, regarding tight control, Material Flow Cost Budgeting, which estimates material flows and related costs for the next period, and Material Flow Investment Appraisal, which considers the net present value of expected future material flow costs, should be adopted to achieve the desired target and can be used to closely monitor eco-efficiency progress (Schaltegger & Zvezdov, 2015). Another implication is that firms should obtain ISO14001 certification since eco-controls conform to some ISO14001 requirements (Arjaliès & Mundy, 2013). The last implication is that eco-labelling, such as green or carbon labelling, is recommended since this eco-marketing practice reflects eco-efficiency in the production process.

Based on the findings of the second article, it is suggested that firms should focus on the regenerative use of resources by using recycled or recyclable materials in production. The quality of the secondary products should be equal to the primary products to maintain brand loyalty, and the distribution channels and targeted customers should be the same as those of the primary product to reduce production and consumption (Zink & Geyer, 2017). Firms that do not have their own brand may consider investing in R&D and brand building to gain a competitive advantage from differentiation (Chen et al., 2016). In addition, firms should apply environmental management accounting tools, such as life cycle assessment (LCA) or material flow cost accounting, to evaluate the environmental and economic benefits resulting from their activities.

For policy makers, it is suggested that the regenerative use of resources should be promoted (Lieder & Rashid, 2016). Waste separation should be encouraged and done at origin in order to lower procurement costs for firms and disposal costs for the community (Mahakhant & Anuwattana, 2019).

LIMITATIONS

This dissertation is subject to limitations which could stimulate further research. Firstly, the research is a cross sectional study. It may not capture the effect of some environmental practices which may take time to be accomplished. Therefore, future research should employ a longitudinal approach to investigate the effect of environmental practices over a longer period. Secondly, the study investigates only some of the contingent variables, such as firm characteristics and firm environmental strategy, which may affect the bureaucratic forms of eco-control adoption. Future research could include other contingent variables, such as perceived stakeholder's concern, top management environmental commitment (Banerjee et al., 2003; Lisi, 2015), perceived ecological environmental uncertainty (Pondeville et al., 2013), and business strategy (Simons, 1990) into the study. Thirdly, for the CE practices, this study focuses on four types of practice. Other CE practices, such as sharing platforms, and their impact on economic performance could be included in future study. Fourthly, the scope of this study is limited to firms in manufacturing industries. As environmental issues have become an increasing concern for organisations in many industries, future research should be extended to other industries outside the manufacturing domain. Finally, this study was conducted in Thailand. The results of the study may be influenced by the characteristics of the national culture, i.e., high degree of power distance and high degree of uncertainty avoidance (Chenhall, 2006; Hofstede, 1984; Vance et al., 1992). Future research conducted in other countries may help to enrich our understanding of the issues related to environmental strategy, environmental controls and firm performance.

Acknowledgements

This dissertation received financial support from The 90th Anniversary of Chulalongkorn University Fund (Ratchadaphiseksomphot Endowment Fund).

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APPENDICES

APPENDIX: SURVEY QUESTIONNAIRE

Section 1: Respondent's profile

1. Position Title:
   - ☐ Chief Executive Officer (CEO)
   - ☐ Chief Operating Officer (COO)
   - ☐ Sustainability Director
   - ☐ Sustainability Manager
   - ☐ Managing Director (MD)
   - ☐ Other (Please specify) ……
2. How long have you served in this position? …… Years
3. How long have you worked in this company? ……. Years

Section 2: Company's profile

1. Industry:
   - ☐ Wood and wood products
   - ☐ Paper and Pulp
   - ☐ Petroleum and coal products
   - ☐ Chemical and chemical products
   - ☐ Basic and fabricated metal products
   - ☐ Machinery
   - ☐ Electronics
   - ☐ Automotive and automotive compartments
   - ☐ Textile
   - ☐ Recycling
   - ☐ Others (Please specify) …….
2. Who are your major customers?
   - ☐ Corporations ☐ Individuals
3. What is the primary activity of your factory?
   - ☐ OEM - Original equipment manufacturer
   - ☐ ODM - Original design manufacturer
   - ☐ OBM - Original brand manufacturer
4. As of the beginning of January 2020, how many full-time equivalent employees worked at your company?
   - ☐ 1 to 50 employees
   - ☐ 51 to 200 employees
   - ☐ Over 200 employees
5. Currently, is your company a subsidiary of an international firm?
   - ☐ Yes, (Please specify country of origin) ☐ No
   - ☐ China
   - ☐ India
   - ☐ Japan
   - ☐ Malaysia
   - ☐ South Korea
   - ☐ Taiwan
   - ☐ The United States
   - ☐ Other ……..

6. Currently, is your company or parent company listed on the stock market?
   ☐ Yes, (SET/MAI) ☐ No
   ☐ Yes, others (Please specify)
   1) ……
   ……
   2) ……
   ……

7. Currently, is your company ISO 14001 certified?
   ☐ Yes, since when (year) ……. ☐ No

Section 3: Competitive environmental strategy

Please indicate the extent to which the integration of environmental aspects within your company is motivated by the following items (1 – not at all to 7 – to a great extent).

Motivation	Less Extent		Moderate			Great Extent	
	1	2	3	4	5	6	7
1. Increasing production efficiency							
2. Reducing costs related to energy and material consumption							
3. Reducing costs related to waste management							
4. Reducing the risk of environmental liabilities and disasters							
5. Extending natural resources and product value for a circular economy							
6. Responding to the green market need							
7. Providing high quality products with low environmental impacts							
8. Providing environmental advantages of the product compared to competing conventional products.							
9. Gaining emotional durability, attachment, and trust from green consumers.							

Section 4: Eco-controls

Please indicate the extent to which you agree or disagree with the following aspects in your company (1 – strongly disagree to 7 – strongly agree).

Eco-controls	Strongly Disagree		Moderate			Strongly Agree	
	1	2	3	4	5	6	7
1. Rather than focusing on the attainment of the environmentally desired targets, monetary and non-monetary environmental performance measures are used to monitor staff decisions and actions on an ongoing basis.							
2. Written rules, policies, procedures, and targets related to environmental aspects are communicated formally to all staff.							
3. Budgets for environmental expenses and investments are very detailed.							

Section 5: Strategic alignment of eco-practices

Please indicate the extent to which you agree or disagree with the following aspects in your company (1 – strongly disagree to 7 – strongly agree).

Strategic alignment of eco-practices	Strongly Disagree		Moderate			Strongly Agree	
	1	2	3	4	5	6	7
1. Links between environmental strategy and production policy are clearly formulated.							
2. Links between environmental strategy and production policy are pursued.							
3. Investments in production are screened for consistency with environmental strategy.							
4. Production activities are consistent with environmental strategy.							
5. Links between environmental strategy and marketing policy are clearly formulated.							
6. Links between environmental strategy and marketing policy are pursued.							
7. Investments in marketing are screened for consistency with environmental strategy.							
8. Marketing activities are consistent with environmental strategy.							

Section 6: Eco-practices

Please indicate the extent to which the following practices are implemented within your company (1 – not at all to 7 – to a great extent).

Eco-practices implementation	Less Extent		Moderate			Great Extent	
	1	2	3	4	5	6	7
1. Redesigning the product and processes to reduce the use of energy and materials (e.g., alternative materials or components, cleaner production)							
2. Redesigning the product and processes to reduce emissions and waste							
3. Redesigning the product and processes to eliminate any potential environmental problems							
4. Redesigning the product or processes for ease of disassembly, material separation and reassembly.							
5. Using waste output from one process into feed stock for another process or into new forms of value							
6. Surveillance of the market for environmental opportunities							
7. Sponsorship of the environmental events							
8. Use of environmental arguments in marketing (e.g., environmental advantages)							
9. Making the product more appealing to green consumers (e.g., use of recycled, recyclable, and certified raw materials)							
10. Applying non-consumerist approaches to sales (e.g., not over-selling, no sales commissions)							
11. Collaboration with stakeholders to address and solve environmental problems and/or issues							
12. Voluntary disclosure of firm's environmental management and impacts							

Section 7: Organisational performance

Please indicate the performance of your company for the past three years on the following dimension compared to your competitors (1 – well below average to 7 – above average).

Organizational performance	Below Average		Moderate			Above Average	
	1	2	3	4	5	6	7
1. Waste management							
2. Water management							
3. Air emission control							
4. Noise management							
5. Smell management							
6. Energy management							
7. Market share							
8. Total revenue							
9. Cash flow from operations							
10. Operating profits							
11. Return on investment (ROI)							

Section 8: Additional comments

Are there any important issues that you would like to add about your company? If so, please comment here.

Please write here:

……

……

……

(Separate sheet)

Please attach your business card with this questionnaire or provide your name and mailing address in the space below. This information will be used only to send you one cutlery set made from wheat straw as a token of our appreciation for participating in this research.
Please fill in the address where you would like the appreciation gift to be sent.

Name:
……
Mailing address:
……...……
……
……

Thank you very much for your participation.

Should you have any questions concerning the questionnaire, please feel free to contact the researcher, Miss Kanya Sannamwong, at (66) xx-xxx-xxxx or kanya.sa@udru.ac.th

VITA

NAME	Kanya Sannamwong
DATE OF BIRTH	17 February 1977
PLACE OF BIRTH	Sakol Nakhon
INSTITUTIONS ATTENDED	Lecturer at Udon Thani Rajabhat University Former audit assistant at EY Thailand Graduated from Faculty of Commerce and Accountancy, Chulalongkorn University
HOME ADDRESS	Udon Thani
AWARD RECEIVED	2nd class honours (Bachelor of Accountancy) Academic excellence award (Master of Accountancy)